



DRIFTMIER
ARCHITECTS

SKAGIT PUD

PN 3675 CAMPUS REPLACEMENT ADMINISTRATION BUILDING

MOUNT VERNON, WASHINGTON

MAY 23, 2023



PROJECT: SKAGIT PUD
PN 3675 CAMPUS REPLACEMENT
ADMINISTRATION BUILDING
1415 FREEWAY DRIVE
MOUNT VERNON, WA 98273

OWNER: SKAGIT PUD
1415 FREEWAY DRIVE
MOUNT VERNON, WA 98273
(360) 424-7104

PREPARED: MAY 23, 2023

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SKAGIT PUD
PN 3675 CAMPUS REPLACEMENT ADMINISTRATION BUILDING

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PART I

Bidding Requirements and
Conditions of the Contract

**INVITATION TO BID
SECTION 00 1100**

BIDS FOR

SKAGIT PUD

PN 3675 CAMPUS REPLACEMENT ADMINISTRATION BUILDING

1.01 NOTICE

General Contractors who meet the requirements of the Contract are invited to submit sealed bids for work involving the construction of a new 23,000 square foot office building and related site work located at 1415 Freeway Drive, Mount Vernon, WA 98273 for Skagit PUD (Owner).

The sealed Bid Proposal Form A and Bid Bond Form will be received at the engineering counter in the main lobby at Owner's current offices located at 1415 Freeway Drive, Mount Vernon, WA 98273 until 10:00 AM Pacific Daylight Time (PDT) on Tuesday, June 27, 2023. The Bid Proposal Form B and other required attachments will be accepted until 11:00 AM PDT, one hour after the submission time for Form A. At which time the bids will be opened and read aloud. Bid Proposals and supporting documents received after the fixed times above will not be considered. The official clock for the bid shall be the clock located at the Engineering Counter in the lobby of the Owner's offices.

The bid and other data submitted will form the basis for the letting of a contract for the work. Proposals shall be submitted on the forms provided in the contract documents, which may be obtained as described below. Bid proposals shall be sealed in an envelope and addressed to Skagit PUD. No bidder may withdraw a bid submitted for a period of sixty (60) days after the day of bid opening.

A Pre-bid Conference will be held at 10:00 AM PDT, Tuesday, June 6th, at the Project Site at 1415 Freeway Drive, Mount Vernon, WA 98273. It is suggested that a representative of each prospective general contractor attends the Pre-bid Conference. Mechanical, electrical and earthwork bidders are strongly encouraged to attend. All follow up site visits (other than at the Pre-bid Conference) must be arranged in advance with the Owner, who will make the site available at its convenience during normal business hours.

The construction work is scheduled to begin on or after August 1st.

Each bid shall be accompanied by a five percent (5%) bid security as described in the Instructions to Bidders. Deposits of bidders will be returned as stated in the Instructions to Bidders. One hundred percent (100%) performance and payment bonds will be required to guarantee the faithful performance of the Contract.

Beginning at 5:00 PM PDT on Friday, May 26th, the contract documents will be available online at Builders Exchange of Washington (425-258-1303) by going to www.bxwa.com and clicking on "Posted Projects", "Public Works", and "PUD #1 of Skagit County". Partial sets will not be issued. An unofficial bid set can be viewed on our website www.SkagitPUD.org.

Skagit PUD reserves the right to (1) reject any and all bids, (2) waive any irregularities and informalities in any bid or in the bidding, (3) change the date, time, and place of bid opening, and (4) revise the Contract Documents at any time prior to the day, date, and time set for bid opening by issuing addenda.

Skagit PUD is an Equal Opportunity and Affirmative Action Employer. Disadvantaged Business Enterprises (Small, Minority and Women Owned Businesses) are encouraged to submit bids.

This project is partially funded through the Washington State Budget, as such, state contracting provisions apply.

All work performed on the project will be subject to current wages for each labor classification per Washington State Prevailing wage rates.

Point of Contact: Sam D. Shipp, P.E., Capital Projects Manager
Shipp@SkagitPUD.org (360) 630-1547

PUBLIC UTILITY DISTRICT NO. 1 OF SKAGIT COUNTY


[George Sidhu \(May 24, 2023 13:51 PDT\)](#)
George Sidhu, P.E., General Manager

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May 26, 2023 (Daily Journal of Commerce)

END OF SECTION

**INSTRUCTIONS TO BIDDERS
SECTION 00 2000**

PART 1 - GENERAL

1.01 SCOPE OF WORK

1. The Project consists of the construction of a new, two-story office building on an existing sports field.
2. Building work includes but not limited to construction of a new, two-story office building with public meeting space, an outdoor plaza and patio, and office spaces.
3. Site-work includes but not limited to cut and fill, aggregate piers, parking lots, fencing and gates, lighting and landscaping.

1.02 DEFINITIONS

- A. The term "Bidding Documents" or "Contract Documents" shall mean the Project Manual and the Drawings, as well as Addenda, clarifications, and other supplemental documents issued prior to execution of the Contract.
- B. The term "Successful Bidder" means the firm with whom the Owner makes an award.
- C. For the purposes of this project, the terms Owner, Skagit PUD, or PUD will be used interchangeably and refer to the Owner.
- D. The project name "PN 3675 Campus Replacement Administration Building" is interchangeable with "PN 3675", and "Administration Building".
- E. Other terms used in these Instructions to Bidders have the meanings assigned to them in the Standard Form of Agreement and General Conditions (**Sections 00 5000 and 00 7000**), Supplementary Conditions (**00 7300**), Special Conditions (**00 7700**), or Division 1 of the Technical Specifications.

1.03 DOCUMENTS

- A. Documents are available on Builder's Exchange.
- B. Submit the BID PROPOSAL FORM and other required sections properly executed as the formal bid. The Owner and Architect assume no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- C. The Owner, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining bids on the Work and do not confer a license or grant for any other use.

1.04 EXAMINATION OF DOCUMENTS AND SITE

Before submitting a proposal:

- A. Each Bidder shall thoroughly examine and be familiar with the Drawings, Project Manual and Specifications and other supplemental documents. Submission of a bid shall constitute an acknowledgment upon which the Owner may rely that the Bidder has thoroughly examined any and all Bidding Documents and all parts thereof. Oversight in regard to the Documents shall in no way relieve the Bidder from any obligations with respect to its proposal or to the Contract. No claim for additional compensation will be allowed which is based upon a lack of knowledge of the Contract Documents.
- B. Each Bidder shall visit and inspect the site of the proposed Work and shall be fully acquainted with the location and actual conditions at the site. Bidders shall arrange site visits with the Owner and check in at Owner's office before proceeding onto the site. The submission of a proposal shall constitute an acknowledgment upon which the Owner may rely that the Bidder has thoroughly examined and is familiar with the site. No claim or additional compensation will be allowed based upon lack of knowledge of the site or information which a reasonable site investigation would disclose.
- C. The Drawings for the Work show conditions based on the best information available. The Owner does not guarantee completeness, precision and dimensions. Each Bidder shall include in the bid a sum sufficient to cover all items required by the Contract. Each Bidder shall rely entirely upon Bidder's own judgment in making the proposal.
- D. Upon agreement between Owner and Bidder, Owner will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of its bid. Bidder shall repair all damage resulting from such investigations and tests.
- E. The lands upon which the Work is to be performed, rights of way for access thereto, and other lands designated for use by Contractor in performing the work are identified on the Drawings.
- F. The submission of a bid will constitute an incontrovertible representation by the Bidder that bidder has complied with every requirement of this Section 1.04, and that the Contract Documents are sufficient in scope and detail to indicate and convey an understanding of all terms and conditions for performance of the Work. If Bidder feels that the Contract Documents are insufficient in any way for bidding and performance of the Work, Bidder shall notify Owner in writing prior to bid opening. Submission of the bid is an incontrovertible representation by the Bidder that Bidder has accepted the Contract Documents as sufficient for bidding and for performance of the Work.

1.05 INTERPRETATIONS AND RESTRICTIONS

- A. All provisions of the Contract Documents are intended to be mutually complementary and anything required in one and omitted from another shall be as binding as if called for in all, and in the event of a conflict in provisions, the Work shall be done in the most satisfactory manner to the Owner. It is the intent of the Contract Documents to include every requisite and necessity to properly furnish the entire Work, notwithstanding the fact that every item necessarily involved may not be particularly mentioned. All Work, when finished, shall be complete and in undamaged condition.
- B. INTERPRETATIONS

1. Should a Bidder find discrepancies in, or omissions from, the Drawings, Specifications or other Contract Documents, or be in doubt as to their meaning, the Bidder should at once notify the Owner in writing, who will send written instructions or Addenda to all Bidders. If clarifications are not provided, the Bidder must include in the bid the more expensive alternative item, product, system, method, approach, etc. needed to complete the work.
2. Bidders and Sub-Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Owner at least seven days prior to the date for receipt of bids. Neither Owner nor Architect will be responsible for oral interpretation. Questions received less than (5) days before bid closes may not be answered.
3. All questions about the meaning or intent of the Contract Documents shall be submitted to the Owner in writing. Replies will be issued by Addenda, notice of which will be emailed to all parties recorded by the Owner as having received the Bidding Documents. Addenda will be available on Builder's Exchange. Only questions answered by formal written addenda will be binding on the Owner.

1.06 CHANGES TO THE CONTRACT DOCUMENTS

- A. The Owner may revise or amend the Contract Documents any time prior to 24 hours before bid opening by issuance of Addenda. Notice of Addenda will be electronically transmitted, if emails addresses have been compiled and shall be construed as incorporated into the Contract Documents and shall become a part hereof. Bidder shall access Addenda through Builder's Exchange and shall acknowledge receipt of each Addendum on the Bid Proposal Form.
- B. Should a contractor, supplier, or manufacturer desire to substitute a comparable manufacturer, process, item of equipment or material other than that specified, it shall furnish to the Owner a written request on the "Substitution Request Form" found at the end of *Section 01 6030*.
 1. Such requests shall be furnished to the Owner at least eight days before bid opening. Telephone approval will not be given. Any item the Contractor plans to substitute which is not submitted for approval and approved, prior to bid opening will be at his/her own risk and the Architect has the right to require the specified item be provided at no additional cost to the Owner and without challenge from the Contractor.
 2. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work including changes in the Work of other contractors that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer.
 3. Should the desired substitute process, item of equipment or material proposed by the Bidder not be included in the Contract by Addenda, the Bidder is invited to include this in a value engineering list with appropriate potential cost savings to the Owner.

- C. The Owner reserves the right to extend the time for receiving and opening bids, and notice of such extensions will be given prior to the originally specified due date to each firm which has been furnished copies of the Bidding Documents by the Owner.

1.07 PREPARATION OF BIDS

- A. Only Proposals made out on the official Bid Proposal Forms will be considered. The completed forms should be without alterations, interlineations, or erasures. Fill in all spaces on the Bid Proposal Forms. Failure to bid upon all alternates called for may cause rejection of proposal.
- B. Bid Proposal forms must be completed in ink or by typewriter. The Proposed price of each item on the form must be stated in numerals. If any written numbers are totally illegible, the bid may be disqualified. If a written number can be interpreted to two separate values, the lower value will be used.
- C. Submit Bid Proposal on the forms furnished by the Owner without alterations. Fill in all spaces on the Bid Proposal Forms; sign in long hand. Failure to bid upon all alternates called for may cause rejection of proposal.
- D. Proposals by corporations or other business entities must be executed in the name of the entity by the president, vice president, or other authorized officer, accompanied by evidence of such person's authority to sign for the entity. The principal business address and state of formation shall be shown below the signature.
- E. No conditions or qualifications will be accepted. Do not attach any explanation or recapitulation of the bid other than that shown on the bid form.
- F. All names must be typed or printed below the signature.
- G. The Proposal shall contain an acknowledgment of receipt of all Addenda.
- H. The address to which communications regarding the Proposal are to be directed must be shown.
- I. The Owner reserves the right to request that a Bidder furnish a statement of Bidder's financial responsibility and technical experience.
- J. Originals may be delivered to the Owner's office during business hours on the bid day. Oral, telephone, facsimile, telegraphic bids or modifications of bids will not be considered.
- K. Bidder-suggested alternate bids and value engineering proposals are encouraged by the Owner. Provide a complete description and potential cost impact to the Contract. However, bidder suggested alternates should not be included in the bid amount.
- L. Fill out and attach all certifications, qualifications forms, and supplemental information as stated herein.
- M. Bidders shall submit both Bid Form A and Bid Form B before the times outlined in the Invitation To Bid. Bidders who fail to submit either of the forms by the specified times shall be disqualified.

1.08 BID PRICES

- A. The bid prices shall be all-inclusive to include the furnishing of all labor, supervision, materials, tools, equipment, permits, all taxes (excluding State of Washington Sales Tax on the contract price), licenses, insurance, bonds, overhead and top accounts, profit, temporary construction, temporary facilities, cleanup and all miscellaneous items for a complete job as required by the Contract Documents, Drawings and Specifications. The Owner will reimburse the Contractor for State of Washington Sales Tax; this tax shall be shown as a separate item on invoices and will be paid on the basis of work completed.
- B. The bid prices shall also include all work to coordinate among the various subcontractors, suppliers, etc. for complete systems installation. The Bidder shall include sufficient funds to cover installation of work that may be excluded by sub-bidders or material suppliers. No change order will be approved for work excluded by any party in the bidding process when the Work is indicated in the Contract Documents.
- C. The cost of furnishing performance and payment bonds and insurance shall be included in the Bid Proposal.

1.09 TIME OF COMPLETION AND LIQUIDATED DAMAGES

- A. Time is of the essence for the work under the contract. Contractors shall note that the Work must commence and be completed within the time limit stated in the Contract Documents. The Contractor awarded the Contract acknowledges and agrees that the harm resulting to Owner on account of the Contractor's failure to complete the Project by the time fixed for completion is extremely difficult of ascertainment. Failure to timely complete the Work will result in liquidated damages pursuant to the Contract Documents.
- B. The Bidder may, at Bidder's option, choose a construction plan and schedule that uses less time than that set out in the Contract as the Contract Time. However, for purposes related to all claims, claims for delay, extensions of time and similar adjustments, the contract time for Substantial Completion shall be the only schedule or Contract Time to be considered. Under this contract, the Owner owns the "float".

1.10 PERFORMANCE AND PAYMENT BONDS AND INSURANCE

- A. The Successful Bidder will be required to obtain and pay for the specified insurance and furnish and pay for 100% Performance and Payment Bond. Furnish bond and insurance in such form as the Owner may prescribe and with insurance and surety companies acceptable to the Owner.
- B. Prior to execution of the Contract, the Contractor shall purchase a commercial insurance policy meeting the requirements of the Contract. The Contractor shall file with the Owner a certified copy of all policies or a Certificate of Insurance acceptable to the Owner evidencing such policies to be in force. **The certificate shall be accompanied by policy endorsements necessary to comply with the requirements of the Contract.** Failure of the Contractor to fully comply with the requirements regarding insurance will be considered a material breach of Contract.

1.11 BID SECURITY: DEPOSIT OR BOND

- A. All bids must be accompanied by bid deposit in the form of a Surety Bond, Postal Money Order, Cashier's Check or Certified Check made payable to the Skagit PUD, in the amount equal to 5% of the amount of the bid proposed as evidence of good faith. The Owner will retain the bid security of the three finalist Bidders until award and execution of the Contract.
- B. Failure of the Successful Bidder to enter into the contract, and to furnish a Contractor's Performance and Payment Bond and required insurance documents within fourteen (14) days after issuance of a Notice of Award may, at Owner's sole option, result in the amount of the bid security being forfeited to the Owner, as liquidated damages, but not as a penalty.

1.12 SUBCONTRACTOR LISTING

- A. Each Bidder shall provide Owner with a list of Subcontractors as follows. Proposed Subcontractors must be licensed according to the state and jurisdiction where the Work is located. **Provide a listing of all mechanical, electrical and plumbing contractors regardless of value; and any other Subcontractor with a value of work greater than 10% of the bid amount. Listing must be provided bid submittal.** A full list of Subcontractors and Sub-subcontractors shall be submitted within 7 days of commencement of the Work.
- B. The list of Subcontractors shall include (1) the name, phone numbers and business address of each Subcontractor proposed to perform or render service for a portion of the Work; and, (2) the portion of the Work to be performed by each proposed Subcontractor. No change may be made to the listing after delivery to Owner without the written consent of the Owner.

1.13 NON-COLLUSION AFFIDAVIT

- A. By signing the Bid Proposal Form, Bidder agrees to sign a non-collusion affidavit. No person, firm, or entity shall be allowed to make, file, or be interested in more than one Proposal for the same work, unless alternative Proposals are invited. A person, firm, or entity who has submitted a sub-proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not thereby disqualified from submitting a Proposal, or quoting prices to other Bidders.
- B. Reasonable grounds for believing that any Bidder is interested in more than one Proposal for the Work will cause the rejection of all Proposals in which said Bidder is interested. If there is reason to believe that collusion exists among the Bidders, none of the participants in such collusion will be considered.

1.14 SUBMISSION, MODIFICATION AND WITHDRAWAL OF PROPOSAL

- A. Proposal shall be submitted no later than the time and at the place indicated in the Request for Proposal. After the expiration of the time for submission of bids, they will be opened at the time and place stated in the Invitation to Bid. Bidders will not be present at time of opening. The Owner will take action after the appropriate review.
- B. Any Bidder may withdraw its bid and bid security prior to the date and time set for the receipt of bids, either in person or by written notice delivered to the Owner before said date and time, at its sole discretion.

1.15 AWARD

- A. Award will be made as a whole to one Bidder. The Owner reserves the right to reject any or all Proposals, and to waive any irregularities or informalities in any bid. The Owner reserves the right to use base bids alone or any combination of base and alternate bids in Owner's determination of the Successful Bidder.
- B. An award, if award is made, will be made within sixty (60) days of the bid submission date and no Bidder may withdraw its bid proposal within such time period. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder.
- C. Within fourteen (14) calendar days after written notice of award has been delivered, the Successful Bidder shall execute the Contract and furnish a Performance and Payment Bond for 100% of the Contract sum, plus sales tax, and the required evidence of insurance for the minimum coverages as described in the Contract Documents. Posting of the Notice of Award by regular mail shall constitute delivery to the Successful Bidder for purposes of this provision.
- D. The Owner shall have the right to select any alternate(s) to the bid throughout the duration of the Project.

1.16 LAWS AND REGULATIONS

- A. The Bidder's attention is directed to the fact that all applicable State Laws, county and city ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.
- B. All written instruments, agreements, bid documents, specifications, and other writings of whatsoever nature which are a part of the work shall be construed for all purposes, solely and exclusively in accordance with and pursuant to the laws of the State of Washington. The rights and obligations of Bidders, the Owner, and Contractor shall be governed by the laws of the State of Washington.

1.17 ACCESS TO FACILITIES, PREMISES AND RECORDS

- A. Representatives of the Owner and the Architect shall have access to the Work whenever it is in preparation or progress, and proper facilities shall be provided by the Contractor for such access and inspection. Representatives shall have access to any books, documents, papers, and records of the Contractor which are pertinent to the project for the purpose of making audit, examination, excerpts, and transcriptions thereof.

END OF SECTION

INFORMATION AVAILABLE TO BIDDERS
SECTION 00 3000

PART 1 - GENERAL

1.01 GENERAL

- A. This Section 00 3000 contains reference to information which is available for the Bidder's review prior to submitting a bid. The information available as described in Supplemental Information in Section 1.04 below is not part of the Contract Documents. This information is provided for the Bidder's convenience and use in understanding the nature and scope of the Work to be performed. The accuracy of site reports and other information contained therein is not warranted by Owner or Architect.
- B. The Bidder's attention is directed to the possible existence of obstructions and public or private improvements which may be within the limits of the Work or adjacent thereto, which may or may not be shown on the Drawings.
- C. The Bidder shall investigate to their satisfaction as to the existing conditions to be encountered; the character, quality, and quantities of Work to be performed; the requirements of the Contract Documents; and the Contract.
- D. Vendor Drawings, Specifications and Notes:
 - 1. The Owner may contract directly with certain suppliers, contractors, vendors, and designers for the provision of materials, equipment and their installation. Information available to Bidders may include items such as design drawings, shop drawings, installation instructions, equipment schedules, and product data. These are current at the time of bid, but may change prior to construction.
 - 2. The Bidders are responsible to include in their bid and in the Work, the coordination of work described in this information by such terms as "by others", "by Owner", "by General (or other) Contractor", "N.I.C.", etc. Contact the Owner for clarification of scope of work questions.

1.02 CONTRACT DOCUMENTS - DRAWINGS

- A. Construction Drawings: A full listing of the drawing sheets to be included in the General Construction Contract Documents is found on the Cover Sheet, CS0.01 and in "Exhibit A" to the "Standard Form of Agreement Between Owner and Contractor."
 - 1. Civil, Landscape, Architecture, Structural, Mechanical, Plumbing, Electrical, Telecommunication, Security and Audio-Visual drawings are included. Security equipment and installation is being provided by the Owner's vendor, but General Contractor's responsibilities includes but is not limited to conduit installation, power connections and coordination.

1.03 CONTRACT DOCUMENTS - PROJECT MANUAL

- A. The Project Manual is included in the Contract Documents for this Project. The Project Manual has two major sections as described herein.

- B. Part I - Bidding Requirements and Conditions of the Contract: This includes CSI Specification Division 00 and the sections listed in the Table of Contents.
- C. Part II - Technical Specifications: This includes the written general requirements, construction processes and material specifications for the construction of the Work. The specifications are organized using CSI Master Format 2015 numbering formats. Divisions 01 through 33 are represented, including the sections listed in the Table of Contents.

1.04 SUPPLEMENTAL INFORMATION: INCLUDED IN PROJECT MANUAL

A. ARCHAEOLOGICAL SURVEY

- 1. No Protected Cultural Resources or Historic Properties were identified during the archaeological investigation. However, bovine remains were discovered, and the construction crew will be required to attend training on site for identifying cultural resources during the course of the work.

B. PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

- 1. Report from Associated Earth Sciences.

C. PHASE 2 ENVIRONMENTAL SITE ASSESSMENT

- 1. Report from Associated Earth Sciences.

D. SOIL ANALYSIS AND RECOMMENDATIONS

- 1. Analysis of existing soils for city requirements on soils for landscaped areas.

E. SOILS REPORT

- 1. Subsurface Exploration, Geologic Hazard, Infiltration Testing, and Preliminary Geotechnical Engineering Report.

F. STORMWATER POLLUTION PREVENTION PLAN

- 1. The document is Appendix C of the Civil Engineer's Stormwater Drainage Report. Full report is available upon request, per below.

G. SURVEY

- 1. NAVD 88 survey.

1.05 SUPPLEMENTAL INFORMATION: AVAILABLE UPON REQUEST

A. EXISTING SITE AND BUILDING PLANS

- 1. Original and past remodel plans are available for the existing facilities upon Request.

B. MOUNDING ANALYSIS

1. Analysis of the groundwater conditions and the proposed stormwater system design.

C. PERMIT APPLICATION MATERIALS (Available upon request)

1. The following permits have been obtained by the Owner and documents are available upon request: Building permit, floodplain development, site plan approval and SEPA, sign permit, fill and grade, right-of-way, and Ecology construction stormwater general permit.

D. REGULATED BUILDING MATERIALS ASSESSMENT REPORT

1. Available for the existing buildings on site.

E. RISE ANALYSIS

1. Evaluation of the proposed construction on the 100-year floodplain.

F. STORMWATER DRAINAGE REPORT

1. Developed by the Civil Engineer.

G. STRUCTURAL CALCULATIONS

1. Structural calculations for the new building and monument sign.

1.06 SECURITY AND CONFIDENTIALITY

- A. Confidentiality of Aspects of Plans and Specifications. The Contract Documents for the Project contain designs, parts, materials and equipment related to security purposes. Such aspects of the Plans and Specifications furnished to Contractor and which the Contractor's employees, agents and subcontractors have access to during the term of the Contract, shall be treated as confidential to the Owner. Any oral or written disclosure to unauthorized individuals is prohibited. No copies of the Plans and Specifications shall be made without the District's prior written approval. All Plans and Specifications in the possession of unsuccessful Bidders shall be returned to Owner following award of the Project contract, or if no bid is submitted, prior to Bid opening or immediately upon request of Owner.

PART 2 – PRODUCTS AND OWNER PROVIDED MATERIALS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 PROPOSAL

**SKAGIT PUD
PN 3675 CAMPUS REPLACEMENT
ADMINISTRATION BUILDING**

**Project Location:
1415 FREEWAY DRIVE
MOUNT VERNON, WA 98273**

TO: Board of Commissioners
Public Utility District No. 1 of Skagit County, Washington

Commissioners:

The undersigned has examined the site, specifications, plans, laws and ordinances covering the improvements contemplated. In accordance with the terms, provisions and requirements of the foregoing, the following lump sums and unit prices are tendered as an offer to perform the Work and furnish the labor, tools, equipment, materials, appurtenances, incidentals, and guarantees, where required, complete in place, in good working order.

As a guarantee of good faith and as required by law, a Bid Deposit in the form of a certified check, cashier's check, postal money order or surety bond made payable to the order of Public Utility District No. 1 of Skagit County ("District") is attached hereto. The undersigned understands and hereby agrees that, should this offer be accepted and the undersigned fail or refuse to enter into a Contract, furnish the required Payment and Performance Bond and required liability insurance, the undersigned shall forfeit to Skagit PUD an amount equal to five percent (5%) of the amount Bid as liquidated damages, all as provided for in this Invitation for Bids.

The undersigned hereby proposes to undertake and complete the work embraced in this improvement, in accordance with the terms of the Specifications and Contract Documents, at the following lump sum and unit prices, exclusive of any State or Local sales taxes:

1.02 TOTAL BASE BID

A. GRAND TOTAL BASE BID

The total of the Construction of the Building INCLUDING all exterior site and building related activities, and FORCE ACCOUNT amount of \$200,000.

\$_____

Included in the above bid are provisions for Trench Safety complying with the Washington Industrial Safety & Health Act, RCW Chapters 39.04 & 49.17. Bidder must include a lump sum dollar amount in blank (even if the value is \$0.00) to be responsive: \$_____

1.03 ALTERNATE BIDS

A. Alternate bids are to be provided with Bid Proposal Form B at the specified time.

1.04 UNIT PRICES

A. See 00 4050 Bid Proposal Form B and 01 2200 Units Prices.

1.05 BID ATTACHMENTS

A. Attach the Deposit or Bid Bond Form described in “00 2000 Instructions to Bidders” and “00 4110 Deposit or Bid Bond Form”.

1.06 BID CONDITIONS

A. INCLUSIONS

We agree that the prices as quoted above are all inclusive and include all labor and material (except as stated on the plans or in the Specification to be furnished by others), supplies, equipment, special tools, costs, insurance, permits, all taxes (exclusive of State of Washington Sales Tax), overhead top accounts, temporary construction and temporary facilities, clean up, profit, and all miscellaneous items for a complete job as specified, provided that, no charge shall be made for materials supplied by Owner.

B. ACCEPTANCE OF CONDITIONS

We agree that we are satisfied as to the nature and location of the work, the general local conditions, and all other matters which can in any way affect the work, the time required to complete the work, or the cost thereof under this Contract. Additional compensation shall not be requested because of our failure to be fully

informed of the conditions under which the work shall be performed and for materials provided by Owner.

C. ACCEPTANCE OF CONSTRUCTION DOCUMENTS

We have fully examined the construction documents including the drawings, details, schedules, technical specifications, bidding and contract conditions, and all parts of the Project Manual. It is our determination that the construction documents provided for bidding this project are sufficient in scope and detail to convey an understanding of all terms and conditions for performance of the work.

After careful examination of the documents, we have brought to the attention of the Architect in writing each instance where we feel there is a lack of clarity, ambiguity or omission. Amounts sufficient to cover these items have been included in the proposed contract sum.

D. CERTIFICATES

The bidder is hereby advised that by signature of this proposal he/she is deemed to have acknowledged all requirements and signed all certificates contained herein.

E. PREVAILING WAGES

The undersigned hereby agrees to pay to labor not less than the prevailing rates of wages or less than the hourly minimum rate of wages as specified in the Specifications and Conditions for this project.

1.07 COMMENCEMENT OF WORK

- A. The undersigned Bidder hereby proposes and agrees to commence work under this Contract, if awarded to him/her, within seven (7) days after the Commencement Date established in the Notice to Proceed.
- B. The work is to be completed within the Contract Time period(s) as stated in the Contract Documents.
- C. In the event the Bidder fails to achieve completion within the above mentioned Contract Time period(s), the Bidder agrees to pay liquidated damages for each consecutive calendar day that the specified Work remains unfinished per the Owner Contractor Agreement.

1.08 CONTRACT AND BOND

- A. As evidence of our good faith, a 5% bid bond or other authorized check is attached.

CASH \$ _____ CASHIER'S CHECK \$ _____

BID BOND \$ _____ CERTIFIED CHECK \$ _____

- B. If notified of the acceptance of this bid within sixty (60) days after the time set for opening bids, we agree to enter into a written Contract with the Owner within fourteen (14) days after written notice of award has been delivered. We agree to furnish the performance and payment bond and insurance as required by the Contract Documents.
- C. We understand that failure to execute and deliver to Owner the Contract Agreement, proof of insurance, performance and payment bonds and proof of compliance with state licensing and Department of Labor and Industries requirements in the manner and time required will result in forfeiture of the bid security. The Owner may then consider other bids.

1.09 WASHINGTON STATE AND LOCAL TAXES

- A. The Owner will pay to the Contractor Washington State and Local Sales Tax at the current applicable rate based on each approved payment amount. The Contractor shall then remit these Sales and Local Sales Tax amounts to the Washington State Department of Revenue.
- B. Contractor shall pay applicable State and local business and occupation, sales and other taxes and Washington State Department of Labor and Industries premiums applicable to its business. Contractor hereby certifies that it has duly registered as an employer and contractor with the Washington State Department of Labor and Industries and has paid all premiums required of Contractor to date.

1.10 BIDDERS ADDRESS

- A. Notice of Acceptance of this Bid or Requests for Additional Information should be addressed to the undersigned at the address stated below.

1.11 ADDENDA

- A. Receipt is hereby acknowledged of Addenda Nos. __, ____, ____, ____, and ____.

1.12 NON-COLLUSION CERTIFICATION

- A. I, by signing the proposal, hereby declare, under penalty of perjury under the laws of the United States that the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.

1.13 ANTI-DISCRIMINATION CERTIFICATION

- A. By signing the Bid Form, the Bidder covenants, stipulates and agrees that no person

shall be discriminated against in the bidding of the service and/or materials hereunder and that the Bidder shall not refuse to hire any person therefore because of such person's race, creed, color or national origin, families with children, marital status, sexual orientation, age or disability unless based on a bona fide occupational qualification. Also, the Bidder will in no matter discriminate against any person because of such person's race, creed, color or national origin. Any such discrimination shall be deemed a violation of this bid and shall render this bid void and subject to forfeiture.

1.14 CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

- A. By signing the Bid Form, the Bidder certifies that, within the three-year period immediately preceding the bid solicitation date, the bidder is not a “willful” violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.
- B. By signing the Bid Form, the Bidder certifies under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

1.15 SIGNATURE

- A. We agree that this proposal as submitted will remain in force for sixty (60) days after the official opening of bids.

Signature _____

Name _____

Firm Name _____

Address _____

Washington State Contractor's License Number

Sworn to before me this _____ day of _____, 20____

(SEAL) NOTARY PUBLIC

1.16 BIDDER'S CHECKLIST FOR BID PROPOSAL FORM A

The following list is offered as a partial checklist of items requiring the Bidder's signature and attention.

1. Is Bid Proposal Form A properly signed and all information present? _____
2. Does the Grand Total Base Bid include the \$200,000 Force Account amount? _____
3. Has receipt of all addenda been filled out and acknowledged? _____
4. Has the Deposit or Bid Bond Form been submitted? (00 4110) _____

PART 2 - PRODUCTS (Not applicable to this Section)

PART 3 - EXECUTION (Not applicable to this Section)

END OF SECTION

PART 1 - GENERAL

1.01 PROPOSAL

**SKAGIT PUD
PN 3675 CAMPUS REPLACEMENT
ADMINISTRATION BUILDING**

**Project Location:
1415 FREEWAY DRIVE
MOUNT VERNON, WA 98273**

TO: Board of Commissioners
Public Utility District No. 1 of Skagit County, Washington

Commissioners:

The undersigned has examined the site, specifications, plans, laws and ordinances covering the improvements contemplated. In accordance with the terms, provisions and requirements of the foregoing, the following lump sums and unit prices are tendered as an offer to perform the Work and furnish the labor, tools, equipment, materials, appurtenances, incidentals, and guarantees, where required, complete in place, in good working order.

As a guarantee of good faith and as required by law, a Bid Deposit in the form of a certified check, cashier's check, postal money order or surety bond made payable to the order of Public Utility District No. 1 of Skagit County ("District") is attached hereto. The undersigned understands and hereby agrees that, should this offer be accepted and the undersigned fail or refuse to enter into a Contract, furnish the required Payment and Performance Bond and required liability insurance, the undersigned shall forfeit to Skagit PUD an amount equal to five percent (5%) of the amount Bid as liquidated damages, all as provided for in this Invitation for Bids.

The undersigned hereby proposes to undertake and complete the work embraced in this improvement, in accordance with the terms of the Specifications and Contract Documents, at the following lump sum and unit prices, exclusive of any State or Local sales taxes:

1.02 TOTAL BASE BID

A. BASE BID – BREAKDOWN

1. MECHANICAL WORK

The subtotal for HVAC, Plumbing, Sprinklers, controls and related work.

\$_____

2. BUILDING ELECTRICAL WORK

The subtotal for line voltage power, fire alarm, security, phone/data cabling, and related work.

\$_____

3. BUILDING GENERAL CONSTRUCTION

The subtotal for Recreation Center general construction including all work related to the buildings not included in the mechanical and electrical base bids above.

\$_____

4. AGGREGATE PIERS

The subtotal for all work related to the construction of the aggregate piers for soil improvements.

\$_____

5. SITE WORK, UTILITIES, PAVING & LANDSCAPING

The subtotal for all site clearing, excavation & grading, utilities, paving, retaining wall, landscaping and all site related work not included in the other base sub-bids above.

\$_____

Included in the above sub-bid are provisions for Trench Safety complying with the Washington Industrial Safety & Health Act, RCW Chapters 39.04 & 49.17. Bidder must include a lump sum dollar amount in blank (even if the value is \$0.00) to be responsive: \$_____

6. FORCE ACCOUNT

The subtotal for all site clearing, excavation & grading, utilities, paving, retaining wall, landscaping and all site related work not included in the other base sub-bids above.

\$200,000_____

B. GRAND TOTAL BASE BID

The total of the Mechanical, Electrical, General Construction, Site Work and Force Account of the Building, representing all base bid work proposed under the Contract. This line includes the sum of Paragraphs A1 through A6 above. If there is a discrepancy between the below number and the number included on the Bid Proposal Form A previously submitted, the number on Bid Proposal Form A will govern.

\$_____

1.03 FORCE ACCOUNT

- A. Payment: The Force Account bid item has been included for any additional work directed by the Owner that is not identified by the original contract. The amount indicated in the proposal for this bid item is to provide a common bid amount. The actual amount paid under this bid item may vary from no payment to the full amount of the bid item. Work performed under this bid item will be initiated with a work directive issued by the Owner.

In lieu of the preceding prescribed method of determining payment for force account work, payment may be made at unit prices or lump sum prices agreed to by the Owner and the Contractor prior to beginning the Force Account work.

For the purpose of providing a common proposal for all bidders, and for that purpose only, the Owner has estimated an amount and included it in the bid item for force account work to become part of the total bid by the Contractor.

1.04 ALTERNATE BIDS

The undersigned proposes to perform the work called for in the Alternates, as listed below, and as described on the drawings and in the specifications, for the following additions/deletions to the Base Bid:

<u>Alternate & Description</u>	<u>Addition</u>	or	<u>Deletion</u>
A1 Remove Builder's Risk Insurance Requirement	\$_____		\$_____

1.05 UNIT PRICES

- A. Also see Section 01 2200 for complete description of Unit Prices. Fill in the unit price amounts.

B. Unit Price No. 1 – Soil Over-Excavation / Disposal of Unsuitable Soil: The Bidder proposes to over-excavate and dispose of off site all unsuitable soil at the proposed building pad areas and the pavement areas, at the following unit price:

\$_____ / cubic yard

C. Unit Price No. 2 – Imported Structural Fill: The Bidder proposes to import, place and compact Structural Fill in place of removed unsuitable material (Unit Price No. 1), at the following unit price:

\$_____ / ton

1.06 BID ATTACHMENTS

- A. Attach to the bid proposal the lists, forms, certifications and affidavits described in the "Instructions to Bidders" and the checklist below.

- B. Exclude the Deposit or Bid Bond Form which was to be submitted with Bid Proposal Form A.

1.07 BID CONDITIONS

All bid conditions and other requirements contained in Section 00 4000, Bid Proposal Form A, remain applicable to the breakdown and unit prices under this Bid Proposal Form B.

SUBMITTED ON _____, 20_____.

1.08 SIGNATURE

- A. We agree that this proposal as submitted will remain in force for sixty (60) days after the official opening of bids.

Date: _____

Proper Name of Bidder

Contractor License Number: _____

Signature, By: _____

Printed Name: _____

Company: _____

Address: _____

Phone Number: _____

E-mail Address: _____

1.09 BIDDER'S CHECKLIST FOR BID FORM B

The following list is offered as a partial checklist of items requiring the Bidder's signature and attention.

1. Is Bid Proposal Form B properly signed and all information present? _____
2. Does the Grand Total Base Bid include the \$200,000 Force Account amount? _____
3. Does the Grand Total Base Bid match the amount inserted on Bid Proposal Form A? _____
4. Does the Grand Total Base Bid amount agree with the sum of the components? _____
5. Has the Bidder's Responsibility Criteria been filled out & submitted (00 4100) _____
6. Has the Statement of Bidder's Qualifications been submitted? (00 4105) _____
7. Has the Subcontractor List been filled out & submitted? (00 4115) _____

END OF SECTION

**BIDDER RESPONSIBILITY CRITERIA
SECTION 00 4100**

PART 1 - GENERAL

1.01 BIDDER RESPONSIBILITY CRITERIA

- A. Washington State defines a “responsible bidder” as a contractor who meets the criteria in RCW 39.04.350. This section describes the process in which bidder responsibility will be determined, outlines the Mandatory Criteria, and sets forth the Supplemental Criteria. All required documentation to be provided by bidders to determine responsibility is to be included in Section 00 4105 Bidder’s Qualifications.

1.02 BIDDER RESPONSIBILITY PROCESS

- A. Per RCW 39.04.350, the mandatory criteria below is required to be provided by the successful bidder. In addition to the mandatory criteria, per RCW 39.04.350, the Owner has the right to require additional Supplemental Bidder Responsibility Criteria for determining bidder responsibility applicable to the project.
- B. A potential bidder has the right to request that the Owner change the supplemental criteria. This must occur no later than **7 days** prior to the bid opening. The Owner will evaluate the information submitted by the potential bidder and respond before the bid submittal deadline. In the evaluation results in a change of the criteria, the Owner will issue an addendum to the bidding documents indentifying the new criteria.
- C. Within **48 hours** of the bid opening, the lowest bidder is required to submit documentation of compliance with the Supplemental Bidder Responsibility Criteria to the Owner and Architect. The Owner may also request that other bidders submit documentation also.
- D. If the bidder(s) fails to supply information requested concerning responsibility within 48 hours, the Owner may base its determination of responsibility upon any available information related to the supplemental criteria or may find the bidder not responsible. Withholding information or failure to submit all the information requested within the time period may render the bid non-responsive and void.
- E. If the Owner determines that the apparent low bidder is not responsible, the Owner will notify the bidder of its preliminary determination in writing.
- F. Within **24 hours** after receipt of the preliminary determination, the bidder may withdraw its bid or request a hearing where the bidder may appeal the preliminary determination and present additional information to the Owner.
- G. The Owner will schedule a hearing within **three (3) working days** of receipt of the bidder’s request. The hearing will include a Contractor Representative(s), Owner Representative(s), and Architect Representative(s).

- H. The Owner will issue a Final Determination after reviewing information presented at the hearing.
- I. If the Owner determines a bidder to be not responsible, the Owner will provide, in writing, the reasons for the determination. If the final determination affirms that the bidder is not responsible, the Owner will not execute a contract with any other bidder until two (2) business days after the bidder determined to be not responsible has received the final determination.
- J. The Owner's Final Determination is specific to this Project, and will have no effect on other or future projects.

1.03 BIDDER RESPONSIBILITY CRITERIA (MANDATORY PER RCW 39.04.350):

- A. It is the intent of Owner to award a contract to the lowest responsible bidder. Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. The bidder may be required by the Owner to submit documentation demonstrating compliance with the criteria. The bidder must:
 - 1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of bid submittal;
 - 2. Have a current Washington Unified Business Identifier (UBI) number;
 - 3. If applicable:
 - a. Have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW;
 - b. Have a Washington Employment Security Department number, as required in Title 50 RCW;
 - c. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
 - 4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).
 - 5. Not have violated the "Off-site Prefabrication" reporting requirement more than one time as determined by the Department of Labor and Industries.
 - 6. Have received training on the requirements related to public works and prevailing wage under chapter 39.04 RCW and chapter 39.12 RCW provided by the department of labor and industries or a person approved by the department OR bidders has completed three or more public works projects and has had a valid business license in Washington for three or more years.
 - 7. Not have been determined by a final and binding citation and notice of assessment issued by the department of labor and industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as

defined in RCW 49.48.082, any provision of chapter 49.46, 49.48, or 49.52 RCW within the three-year period immediately preceding the date of the bid solicitation.

B. As evidence that the bidder meets the mandatory bidder responsibility criteria in paragraph A above, the apparent low bidder must submit documentation to the Owner within 48 hours of the bid submittal deadline (fill out section 00 4105). The Owner reserves the right to request such documentation from other bidders also.

1. Certificate of Registration: Supply number
2. Washington UBI number: Supply number
3. If applicable:
 - a. Industrial Insurance: Supply number or reason why it is not applicable.
 - b. WESD: Supply number or reason why it is not applicable.
 - c. WDR tax number: Supply number or reason why it is not applicable.
4. Unregistered Contractors and Prevailing Wages: Owner will verify with L&I that Contractor has not been disqualified.
5. Prevailing Wages: The Bidder shall submit a list of prevailing wage complaints filed against it within five years of the bid submittal date along with an explanation of each complaint and how it was resolved. The Owner shall evaluate these explanations and the resolution of each complaint to determine whether the complaints demonstrate a pattern of failing to pay its workers prevailing wages as required. The Owner may also evaluate complaints filed within the time period specified that were not reported by the Bidder.

Wash. State Dept. of Licenses Contractor's Registration #: _____

Wash. Unified Business Identifier (UBI) #: _____

Wash. State Industrial Insurance (workers' compensation) #: _____

Wash. Employment Security Department #: _____

Wash. Department of Revenue State Excise Tax Registration #: _____

IRS Employer Number: _____

Or, if individual, Social Security Number: _____

1.04 SUBCONTRACTOR RESPONSIBILITY (MANDATORY PER RCW 39.04.350)

- A. The Contractor shall include the language of this section in each of its first tier subcontracts, and shall require each of its subcontractors to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Owner, the Contractor shall promptly provide documentation to the Owner demonstrating that the subcontractor meets the subcontractor responsibility criteria below. The requirements of this section apply to all subcontractors regardless of tier.
- B. The Bidder shall submit a copy of its standard subcontract form for review by the Owner, and a written description of its procedure for validating the responsibility of subcontractors with which it contracts. At the time of subcontract execution, the

Contractor shall verify that each of its first tier subcontractors meets the following bidder responsibility criteria:

1. Have a current certificate of registration in compliance with chapter 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;
2. Have a current Washington Unified Business Identifier (UBI) number;
3. If applicable, have:
 - a. Have Industrial Insurance (workers' compensation) coverage for the subcontractor's employees working in Washington, as required in Title 51 RCW;
 - b. A Washington Employment Security Department number, as required in Title 50 RCW;
 - c. A Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
 - d. An electrical contractor license, if required by Chapter 19.28 RCW;
 - e. An elevator contractor license, if required by Chapter 70.87 RCW.
4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065 (3).
5. Not have violated the "Off-site Prefabrication" reporting requirement more than one time as determined by the Department of Labor and Industries.

Bidder confirms that they will include wording from this Section 00 4100, Bidder Responsibility Criteria, Section 1.04B, into all contracts with subcontractor for this Project. Bidder has also attached a copy of its standard subcontract form for review by Owner, and a written description of its procedure for validating the responsibility of subcontractors with which it contracts.

Initial

1.05 SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA

- A. In addition to the bidder responsibility criteria in Sections 1.03 and 1.04, the bidder must also meet the following relevant supplemental bidder responsibility criteria applicable to the project:
 1. Delinquent State Taxes: The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.
 2. Federal Debarment: The Bidder shall not currently be debarred or suspended by the Federal government.

3. Public Bidding Crime: The Bidder shall not have been convicted of a crime involving bidding on a public works contract within five years from the bid submittal deadline.
4. Termination for Cause: The Bidder shall not have had any public works contract terminated for cause by a government agency during the five year period immediately preceding the bid submittal deadline for this project, unless there are extenuating circumstances acceptable to the Owner.
5. Lawsuits: The Bidder shall not have lawsuits with judgments entered against the Bidder within five years of the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances acceptable to the Owner.
6. Claims Against Retainage and Bonds: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects during the previous three years, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances acceptable to the Owner.
7. Liquidated Damages. The Bidder shall not have been assessed liquidated damages related to the performance of a public works contract by a government agency during the five (5) year period immediately preceding the bid submittal deadline for this Project.
8. Completion of Similar Projects (Company): The Bidder (company) shall have successfully completed projects of a similar size and scope as required by the contract documents for this project. In evaluating whether the projects were “successfully completed,” the Owner may check owner references for the previous projects and may evaluate the owner’s assessment of the Bidder performance, including but not limited to the following areas:
 - a. Quality control;
 - b. Safety record;
 - c. Timeliness of performance;
 - d. Use of skilled personnel;
 - e. Management of subcontractors;
 - f. Availability of and use of appropriate equipment;
 - g. Compliance with contract documents;
 - h. Management of submittals process, change orders, and close-out

9. Completion of Similar Projects (Superintendent): The proposed Superintendent shall have successfully completed projects of a similar size and scope as required by the contract documents for this project. In evaluating whether the projects were “successfully completed,” the Owner may check owner references for the previous projects and may evaluate the owner’s assessment of the Superintendent’s performance, including but not limited to the following areas:
 - a. Quality control;
 - b. Safety record;
 - c. Timeliness of performance;
 - d. Use of skilled personnel;
 - e. Management of subcontractors;
 - f. Availability of and use of appropriate equipment;
 - g. Compliance with contract documents;
 - h. Management of submittals process, change orders, and close-out
 10. Completion of Public Project (Project Manager): The proposed Project Manager shall have completed at least (1) other public project in the State of Washington. This includes but is not limited to filing intents to pay prevailing wages, affidavit of wages paid, and state mandated retainage. In evaluating whether the projects were “successfully completed,” the Owner may check owner references for the public project(s) and may evaluate the owner’s assessment of the Project Manager’s performance, including but not limited to the following areas:
 - a. Intents to pay prevailing wages;
 - b. Affidavit of wages paid;
 - c. State mandated retainage;
 - d. Timeliness of performance;
 - e. Use of skilled personnel;
 - f. Management of subcontractors;
 - g. Compliance with contract documents;
 - h. Management of submittals process, change orders, and close-out
- B. As evidence that the bidder meets the bidder responsibility criteria in paragraph A above, the apparent low bidder must submit the following documentation to the Owner within 48 hours of the bid submittal deadline. The Owner reserves the right to request such documentation from other bidders also.
1. Delinquent State Taxes: The Bidder shall sign a statement (on the form included in this Section 00 4100) that the Bidder shall not be listed by the Washington State Department of Revenue’s as a Delinquent Taxpayer.
 2. Federal Debarment: The Bidder shall sign a statement (on a form included in this Section 00 4100) that the Bidder shall not be listed as a current debarred or suspended bidder on the U.S. General Services Administration’s “Excluded Parties List System” website: <http://www.epls.gov/>.
 3. Public Bidding Crime: The Bidder shall sign a statement (on a form to be

included in this Section 00 4100) that the Bidder has not been convicted of a crime involving bidding on a public works contract. The Owner may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this criterion.

4. Termination for Cause: The Bidder shall sign a statement (on a form included in this Section 00 4100) that the Bidder has not had any public works contract terminated for cause by a government agency during the five (5) year period immediately preceding the bid submittal deadline for this project. The Owner may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this criterion.
5. Lawsuits: The Bidder shall sign a statement (on a form include in this Section 00 4100) that the Bidder does not have lawsuits with judgments entered against the Bidder within five years of the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts. In the event the Bidder does have a history of such lawsuits with judgments entered against the Bidder within five years of the bid submittal date, the Bidder shall submit a list of such lawsuits , along with a written explanation of the circumstances surrounding each such lawsuit. The Owner shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet of terms of construction related contracts. The Owner may also evaluate lawsuits within the time period specified that are not reported by the Bidder.
6. Claims Against Retainage and Bonds: The Bidder shall submit a list of the public works projects completed within the previous three years and include for each project the following information:
 - a. The owner and contact information for the owner;
 - b. A list of claims filed against the retainage and/or payment bond for any of the projects listed;
 - c. A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

The Owner may contact previous owners to validate the information provided by the Bidder.

7. Liquidated Damages. The Bidder shall sign a statement (on a form included in this Section 00 4100) that the Bidder has not been assessed liquidated damages related to the performance of a public works contract by a government agency during the five (5) year period immediately preceding the bid submittal deadline for this Project. The Owner may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this requirement.
8. Mandatory Bidder Responsibility Checklist: The Bidder shall fill out the mandatory bidder responsibility checklist (on a form included in this Section 00 4100).

9. Subcontractor Responsibility Checklist: The Bidder shall fill out the subcontractor responsibility checklist (on a form included in this Section 00 4100) **for each of the subcontractors listed in 00 4115 Subcontractor List**.
10. Certification of Compliance with Wage Payment Statutes: The Bidder shall sign a statement (on a form included in this Section 00 4100) that the Bidder has not been a “willful” violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW during the three (3) year period immediately preceding the bid submittal deadline for this Project. The Owner may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this requirement.
11. Completion of Similar Projects (Company): The Bidder shall submit a list of projects of similar size and scope to this project that the Bidder completed. For the purposes of meeting this criterion, the Owner has determined that “similar size and scope to this project” means projects that have the following characteristics:
 - a. Completed within the last 10 years.
 - b. Total project cost of at least \$8,000,000.
 - c. Construction of new or remodeled building.
 - d. Use of subcontractors on project.

The information about each project shall include the following:

- a. Owner’s name and contact information for the owner’s representative;
- b. Awarded contract amount;
- c. Final contract amount;
- d. A description of the scope of the project and how the project is similar to this project;
- e. The Bidder’s assessment of its performance of each project, including but not limited to items outlined in above 1.05A(8).

12. Completion of Similar Projects (Superintendent): The Bidder shall submit a list of projects of similar size and scope to this project that the proposed Superintendent completed. For the purposes of meeting this criterion, the Owner has determined that “similar size and scope to this project” means projects that have the following characteristics:
 - a. Completed within the last 10 years.
 - b. Total project cost of at least \$8,000,000.
 - c. Construction of new or remodeled building.
 - d. Use of subcontractors on project.

The information about each project shall include the following:

- a. Owner’s name and contact information for the owner’s representative;
- b. Awarded contract amount;
- c. Final contract amount;
- d. A description of the scope of the project and how the project is similar to this project;

- e. The Superintendant's assessment of their performance for each project, including but not limited to items outlined in above 1.05A(9).

13. Completion of Similar Projects (Project Manager): The Bidder shall submit a list of projects of similar size and scope to this project that the proposed Project Manager completed. For the purposes of meeting this criterion, the Owner has determined that "similar size and scope to this project" means projects that have the following characteristics:

- a. Public Project completed within the last 5 years.
- b. Total project cost of at least \$5,000,000.
- c. Use of subcontractors on project.

The information about each project shall include the following:

- a. Owner's name and contact information for the owner's representative;
- b. A description of the scope of the Public project;
- c. The Project Manager's assessment of their performance for each project, including but not limited to the items outlined in above 1.05A(10).

1.06 SUPPLEMENTAL SUBCONTRACTOR RESPONSIBILITY CRITERIA

- A. There are criteria for specific subcontractor found within the technical specifications. Subcontractors are to verify they meet requirements set forth in the specifications prior to bidding.
 - 1. Others require installer to be certified by the manufacturer in order for warranty to be valid.

(To be returned with Supplemental Bidder Criteria)

DELINQUENT TAXPAYER

I _____ (please print full name), official
representative of

_____ (please print
business name)

Do hereby declare that I, nor the company I represent:

Is not listed on the Washington State Department of Revenue's "Delinquent Taxpayer List"
website: <http://dor.wa.gov/content/fileandpaytaxes/latefiling/dtlwest.aspx>.

SIGNED: _____

DATE: _____

(To be returned with Supplemental Bidder Criteria)

FEDERAL DEBARMENT

I _____ (please print full name), official
representative of

_____ (please print
business name)

Do hereby declare that I, nor the company I represent:

is not listed as a current debarred or suspended bidder on the U.S. General Services
Administration's "Excluded Parties List System" website: <http://www.epls.gov/>.

SIGNED: _____

DATE: _____

(To be returned with Supplemental Bidder Criteria)

PUBLIC BIDDING CRIME

I _____ (please print full name), official
representative of

_____ (please print
business name)

Do hereby declare that I, nor the company I represent:

Has not been convicted of a crime involving bidding on a public works contract

SIGNED: _____

DATE: _____

(To be returned with Supplemental Bidder Criteria)

TERMINATION

I _____ (please print full name), official
representative of

_____ (please print
business name)

Do hereby declare that I, nor the company I represent:

has not had any public works contract terminated for cause by a government agency during the five (5) year period immediately preceding the bid submittal deadline for this Project. The District may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this requirement.

SIGNED: _____

DATE: _____

(To be returned with Supplemental Bidder Criteria)

Litigation

I _____ (please print full name), official
representative of

_____ (please print
business name)

Do hereby declare that I, nor the company I represent:

not been a plaintiff or defendant in the Puget Sound region (defined as Skagit, Whatcom, King, Kitsap, Pierce, Snohomish and Thurston Counties) or federal district court for Western Washington in the last five (5) years involving performance or payment issues relating to a public works contract which were resolved adversely to the Bidder through judgment or settlement. The District may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this requirement.

SIGNED: _____

DATE: _____

(To be returned with Supplemental Bidder Criteria)

Liquidated Damages

I _____ (please print full name), official
representative of

_____ (please print
business name)

Do hereby declare that I, nor the company I represent:

has not been assessed liquidated damages related to the performance of a public works contract by a government agency during the five (5) year period immediately preceding the bid submittal deadline for this Project. The District may also use independent sources of information that may be available to demonstrate whether the Bidder is in compliance with this requirement.

SIGNED: _____

DATE: _____

Mandatory Bidder Responsibility Checklist

The following checklist is to be completed and submitted by the Bidding Contractor.

General Information	
Project Name:	Project Number:
Bidder's Business Name:	Bid Submittal Deadline:
Contractor Registration – https://fortress.wa.gov/lni/bbip/	
License Number:	Status: Active: Yes ☐ No ☐
Effective Date (must be effective on or before Bid Submittal Deadline):	Expiration Date:
Is Bidder on Infraction List?	Yes ☐ No ☐
Current UBI Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/	
UBI Number:	Account Closed: Open ☐ Closed ☐
Industrial Insurance Coverage – https://fortress.wa.gov/lni/crpsi/MainMenu.aspx	
Account Number:	Account Current: Yes ☐ No ☐
Employment Security Department Number –	
Employment Security Department Number:	
• Has Bidder provided account number on the Bid Form? Yes ☐ No ☐ • And/or have you asked the Bidder for documentation from Employment Security Department on account number? Yes ☐ No ☐	
State Excise Tax Registration Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/	
Tax Registration Number:	Account Closed: Open ☐ Closed ☐
Not Disqualified from Bidding – http://www.lni.wa.gov/TradesLicensing/PrevWage/AwardingAgencies/DebarredContractors/default.asp	
Is the Bidder listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries? Yes ☐ No ☐	
Checked by:	
Name of Employee:	Date:

Subcontractor Responsibility Checklist

The following checklist is to be used by Contractors and Subcontractors in documenting that a subcontractor of any tier meets the subcontractor responsibility criteria.

General Information			
Project Name:		Project Number:	
Subcontractor's Business Name:		Subcontract Execution Date:	
Contractor Registration – https://fortress.wa.gov/lni/bbip/			
License Number:		Status: Active: Yes ☐ No ☐	
Effective Date (must be effective on or before Subcontract Bid Submittal Deadline):		Expiration Date:	
Current UBI Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/			
UBI Number:		Account Closed: Open ☐ Closed ☐	
Industrial Insurance Coverage – https://fortress.wa.gov/lni/crpsi/MainMenu.aspx			
Account Number:		Account Current: Yes ☐ No ☐	
Employment Security Department Number –			
Employment Security Department Number:			
- Has Subcontractor provided account number on the Bid Form? - And/or have you asked the Subcontractor for documentation from Employment Security Department on account number?		Yes ☐ No ☐ Yes ☐ No ☐	
State Excise Tax Registration Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/			
Tax Registration Number:		Account Closed: Open ☐ Closed ☐	
Not Disqualified from Bidding – http://www.lni.wa.gov/TradesLicensing/PrevWage/AwardingAgencies/DebarredContractors/default.asp			
Is the Subcontractor listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries? Yes ☐ No ☐			
Contractor Licenses – https://fortress.wa.gov/lni/bbip/			
<u>Electrical:</u> If required by Chapter 19.28 RCW, does the Subcontractor have an Electrical Contractor's License? Yes ☐ No ☐		<u>Elevator:</u> If required by Chapter 70.87 RCW, does the Subcontractor have an Elevator Contractor's License? Yes ☐ No ☐	
Checked by:			
Name of Employee:		Date:	

Certification of Compliance with Wage Payment Statutes

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date (June 27, 2023), the bidder is not a “willful” violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

I certify under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

Bidder

Signature of Authorized Official*

Printed Name

Title

Date

City

State

Check One:

Individual ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

State of Incorporation, or if not a corporation, State where business entity was formed:

If a co-partnership, give firm name under which business is transacted:

** If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.*

END OF SECTION

STATEMENT OF BIDDER'S QUALIFICATIONS
SECTION 00 4105

PART 1 - STATEMENT OF BIDDER'S QUALIFICATIONS

1.01 GENERAL

Name of Contractor: _____

Address: _____

Contact Person for this Bid: _____ Telephone _____

Email: _____

Number of years the Contractor has been engaged in the construction business under the present
firm name indicated: _____

Gross dollar amount of work under contract: _____

Gross dollar amount of contracts not completed: _____

Wash. State Dept. of Labor and Industries Worker's Compensation Acct. #: _____

Wash. State Dept. of Licenses Contractor's Registration #: _____

IRS Employer Number : _____

Or, if individual, Social Security Number: _____

How many general superintendents or other responsible employees in a supervisory position do
you have at this time and how long have they been with the Contractor?

Bank References:

Bank (Institution): _____ Branch: _____

Contact: _____ Phone: _____ Email: _____

Bonding Company Contact::

Broker (Company): _____ City, State: _____

Contact: _____ Phone: _____ Email: _____

Have you changed bonding companies within the last three years? _____

If so, why? (optional)

Who was the most recent bonding company prior to current? _____

Name of insurance company (include phone number, policy number and agent's name)

Have you reviewed the insurance requirements as stated in Section 00 7700, Special Condition, Article 11- Insurance & Bonds in addition to Section 00 6440, Insurance Endorsement? _____

Can you meet the insurance requirements as stated in Section 00 7700, Special Condition, Article 11- Insurance & Bonds in addition to Section 00 6440, Insurance Endorsement? _____

What is your current insurance company's best rating? _____

Bidder confirms the below (or attached) is a full and complete list of all public works projects completed within the previous five (5) years.

Initial

Bidder confirms that all answers in this document are complete and truthful to the best of their knowledge.

Signature

Printed Name

Date

MUST ACCOMPANY EACH BID

END OF SECTION

DEPOSIT OR BID BOND FORM
SECTION 00 4110

PART 1 - GENERAL

1.01 DESCRIPTION

- A. A bid security in the form of a deposit or bid bond is required for submission of a bid. Complete this Section, attach the bid security and submit as part of the Bid.
- B. **GENERAL CONTRACT:** Whereas, the Principal has submitted a bid to perform all Work required for the Skagit PUD's "PN 3675 Campus Replacement Administration Building" project in Mount Vernon, Washington as contained in the Contract Documents dated May 23, 2023, the following Bid Security is submitted.

1.02 DEPOSIT STATEMENT

- A. Herewith find the bid security deposit in the form of certified check, cashier's check or cash in the amount of \$ _____, which amount is not less than five percent of the Grand Total Base Bid as set forth on the Bid Proposal Form A.
- Signature: _____ Bidder: _____
- B. Return of Deposit:
- The deposit sum of \$ _____ was returned on _____, 20____, on which day it was transmitted via: _____.
- By: _____ Company: _____

1.03 BID BOND

KNOW ALL PEOPLE BY THESE PRESENTS:

That we, _____,
as Principal, and _____, as
Surety, are held firmly bound unto Skagit PUD, as Obligee, in the penal sum of _____
_____ Dollars, for the payment of which the Principal and
the Surety bind themselves, their heirs, executors, administrators, successors, and assigns,
jointly and severally by these presents.

The condition of this obligation is such that if the Obligee shall make any award to the Principal for the Skagit PUD's "PN 3675 Campus Replacement Administration Building" project in Mount Vernon, Washington, according to the terms of the bid made by the Principal therefore, the Principal shall duly make and enter into a contract with the Obligee in accordance with the terms of said proposal or bid and award and shall give bond for the faithful performance thereof, with Surety or Sureties approved by the Obligee, or if the Principal shall, in case of failure to so do, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void;

otherwise, it shall be and remain in full force and effect, and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this bond.

SIGNED, SEALED, AND DATED THIS _____ DAY OF _____, 20__.

Principal:	Signature	_____
	Name	_____
	Company	_____

Attorney-in-Fact, Surety	Signature	_____
	Name	_____
	Company	_____
	Local Agent	_____
	Address	_____ _____ _____
	Phone/Fax	_____ / _____

MUST ACCOMPANY EACH BID

END OF SECTION

**SUBCONTRACTOR LIST
SECTION 00 4115**

PART 1 - GENERAL

SUBCONTRACTORS LIST – RCW 39.30.060 FORM

In compliance with RCW 39.30.060 for all projects estimated to cost \$1 million or more, all Bidders must complete and submit this Subcontractors List form with their Bid Proposal.

List of Subcontractors: The Bidder shall indicate on the Subcontractors List the names of the subcontractors with whom the Bidder, if awarded the contract, will subcontract for performance of the work of heating, ventilation and air conditioning, plumbing as described in Chapter 18.106 RCW, and electrical as described in Chapter 19.28 RCW.

List Bidder if Bidder Performing Work: If the Bidder will perform the work in any of the three areas required, the Bidder shall name itself for the work on the Subcontractors List.

Name Only One Form for Each Category of Work: The Bidder shall not list more than one firm (subcontractor or Bidder) for each category of work identified, unless subcontractors vary with bid alternates or additive, in which case the Bidder must indicate which firm will be used for which alternate or additive.

Substitution of Subcontractors: Substitution of any listed subcontractor may only be according to the procedure and parameters set forth in RCW 39.30.060.

Factors relating to Non-Responsiveness: Failure of the Bidder to submit the names of such subcontractors, or to name itself to perform such work, or the naming of two or more firms (subcontractor or Bidder) to perform the same work shall render the Bidder's bid non-responsive and, therefore, void.

Applicable to Direct Subcontractors: The requirement of this section to name the Bidders' proposed heating, ventilation and air conditioning, plumbing and electrical subcontractors applies only to proposed heating, ventilation and air conditioning, plumbing and electrical subcontractors who will contract directly with the Bidder.

Submission Requirements: The Subcontractors List must be submitted with the Bid Proposal Form B.

Trade	Bidder must check one box for each Trade. If subcontracting the work, Bidder must name the subcontractor.
HVAC (Heating, Ventilation and Air Conditioning)	☐ N/A (this project does not include this work) ☐ Bidder will self-perform this work ☐ Name and address of subcontractor
Plumbing	☐ N/A (this project does not include this work) ☐ Bidder will self-perform this work ☐ Name and address of subcontractor
Electrical	☐ N/A (this project does not include this work) ☐ Bidder will self-perform this work ☐ Name and address of subcontractor
Structural Steel Installation	☐ N/A (this project does not include this work) ☐ Bidder will self-perform this work ☐ Name and address of subcontractor
Rebar Installation	☐ N/A (this project does not include this work) ☐ Bidder will self-perform this work ☐ Name and address of subcontractor

MUST ACCOMPANY BID FORM B

END OF SECTION

|

**PERFORMANCE AND PAYMENT BOND
SECTION 00 4120**

PART 1 - GENERAL

1.01 DESCRIPTION

This section is the Performance and Payment Bond Form which is required to be completed by the successful Bidder as stated in the Contract Documents. **Do not** execute the Performance and Payment Bond as part of the Bid Proposal submission.

1.02 PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN/WOMEN BY THESE PRESENTS, That we, _____, the Contractor named in the Contract hereinafter referred to as PRINCIPAL, and _____ as SURETY, are held and firmly bound unto the State of Washington, and unto the Skagit PUD, hereinafter called the OWNER named in said Contract, PN 3675 Campus Replacement Administration Building project in Mount Vernon, **Washington** in the full sum of _____ DOLLARS (\$_____), lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, assigns, administrators and successors jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that Whereas, the Principal entered into a contract with the Owner, dated _____, 2019, for providing for the construction of the Headquarters Expansion Contract, according to the terms, conditions and covenants specified in the agreement including all of the Contract Documents therein referred to, which are hereby referred to and made a part hereof as fully and completely as though set forth in detail herein.

WHEREAS, it is understood and made a part of the consideration for this obligation that the Owner shall have the right to sue on this bond in its own name to recover for any loss, injury, damage or liability whatsoever sustained or incurred by it by reason of any breach of the contract documents, or of any provision in this bond, in the same manner and to the same extent as though this obligation ran directly to the Owner.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform all of the provisions and fulfill all of the undertakings covenants, terms, conditions and agreements of said Contract during the period of the original Contract and any extensions thereof that may be granted by the Owner, with or without notices to the surety; and during the life of any guarantee required under the Contract; and shall also well and truly perform and fulfill all of the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said Contract that may hereafter be made; notice of which modifications to the surety being hereby waived; and furthermore shall pay all laborers, mechanics, and subcontractors and material men, and all persons who shall supply such person or persons and such principal or subcontractors with provisions and supplies for the carrying on of such Work, shall indemnify and save harmless Owner from all costs and damage by reason of the Principal's default of failure to do so, and shall pay the State of Washington sales and use taxes, and amounts due said state pursuant to Titles 50 and 51 of the revised Code of Washington, and shall further indemnify the workmanship or materials entering into any part of the Work as defined in the agreement that shall develop or be discovered within one (1) year after the final acceptance of such Work, then this obligation shall be

null and void, otherwise to remain in full force and effect; provided, that the provisions of this bond shall not apply to any money loaned or advanced to the Principal or any Subcontractor or other person in the performance of any such Work.

IT IS FURTHER DECLARED AND AGREED that nothing of any kind or nature whatsoever that will not discharge the Principal shall operate as a discharge or release of liability of the Surety, any law, rule of equity or usage relating to the liability of sureties to the contrary notwithstanding.

This bond, may be executed in two (2) original counterparts, to be signed by their duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed power of attorney authorizing execution of the bond by the officer executing on behalf of the surety.

PRINCIPAL

SURETY

Principal Signature

Date

Surety Signature

Date

Printed Name

Printed Name

Title

Title

Name, address, and telephone of local office/agent of Surety Company is:

END OF SECTION

**CERTIFICATE OF INSURANCE
SECTION 00 4200**

PART 1 - GENERAL

1.01 DESCRIPTION

Prior to execution of the Contract Agreement, the Contractor shall file with the Owner a certified copy of all required policies of insurance and a Certificate of Insurance evidencing such policies to be in force and in compliance with the Insurance Coverage requirements of Article 11 of 00 7700 Special Conditions.

1.02 CERTIFICATE

The Contractor shall maintain a Comprehensive General Liability insurance policy meeting the requirements set forth herein during the term of the Agreement. The Contractor shall file with the Owner a certified copy of all policies and a Certificate of Insurance evidencing such policies to be in force and in compliance with the insurance requirements. The certificate shall be accompanied by such policy endorsements as are necessary to comply with the requirements set forth herein.

The Contractor shall not begin Work under the Contract until all required insurance has been obtained and until such insurance has been approved by the Owner. The coverage so provided shall protect against claims from bodily injuries, including accidental death, as well as claims for property damages which may arise from any act or omission of the Contractor, his subcontractors, or by anyone directly or indirectly employed by them.

The insurance policies shall specifically name the Owner, its elected or appointed officers, officials, employees, consultants, volunteers, and the Architect as insureds with regards to damages and defense of claims arising from: (a) activities performed by or on behalf of the Contractor; or (b) products and completed operation of the Contractor, or (c) premises owned, leased, or used by the Contractor.

Providing of coverage in the stated amounts shall not be construed to relieve the Contractor from liability in excess of such limits, or from liability not covered from or by said insurance.

In addition, the Contractor shall have its Insurance Agent/Representative complete the Insurance Coverage Questionnaire and the endorsements and attach them to the Certificate of Insurance for Owner's approval.

The contractual coverage of the Contractor's policy shall be sufficiently broad to insure the indemnification requirements of the Contract Documents.

TYPES AND LIMITS OF INSURANCE REQUIRED

Types and limits of the insurance required under this Contract are set forth in the Special Conditions, Article 11 and the endorsement requirements set out in Section 00 4230, Insurance Endorsement. The attention of prospective bidders is drawn to the provisions stated therein.

END OF SECTION

INSURANCE COVERAGE QUESTIONNAIRE
SECTION 00 4220

NOTE: THIS QUESTIONNAIRE MUST BE COMPLETED AND ATTACHED TO
CERTIFICATE OF INSURANCE.

For: _____
(Name of Insured)

Project Title: _____

Project Owner: Skagit PUD

Are the following coverages and/or conditions in effect?

	Yes	No
The Policy form is ISO Commercial General Liability form GC -00 01 or GC 00 02 (circle one). If No, attach a copy of the policy with required coverages clearly identified		
The Owner, its officials, officers, employees, consultants, and volunteers are additional insureds as respects (a) activities performed for the Owner by or on behalf of the Named Insured, (b) products and completed operations of the Named Insured, or (c) premises, owned, leased, or used by the Named Insured.		
Products Completed operation coverage		
Cross Liability clause (or equivalent wording)		
Personal Injury Liability Coverage (with employee exclusion deleted)		
Broad Form Damage with X, C U Hazards included		
Blanket Contractual Liability coverage applying to this contract or Contractual Liability Coverage applying to this contract		
Employers Liability - Stop Gap		
45 days written notice of cancellation to the Owner		

Deductibles or SIRS: GL _____ AL _____ Excess _____

Insurer's Best Rating GL _____ AL _____ Excess _____

This questionnaire is issued as a matter of information. This questionnaire is not an insurance policy and does not amend, extend, or alter the coverage afforded by the policies indicated on the attached Certificate of Insurance.

Agency/Broker _____ Completed by (type) _____

Address _____ Completed by (Signature) _____

Name of person to contact _____ Telephone Number _____

**INSURANCE ENDORSEMENT
SECTION 00 4230**

In consideration of the premium charged it is hereby agreed and understood that Policy No. _____ issued by _____ Insurance Co., is amended to include the following terms and conditions as respects to the PN 3675 Campus Replacement Administration Building project issued by the Skagit PUD.

1. **INSURED.** Skagit PUD, its elected or appointed officers, officials, employees, architect, consultants and volunteers are included as insureds with regard to damages and defense of claims arising from: (a) activities performed by or on behalf of the NAMED INSURED; or (b) products and completed operations of the NAMED INSURED, or (c) premises owned, leased or used by the NAMED INSURED.
2. **CONTRIBUTION NOT REQUIRED.** With respect to (a) work performed by the NAMED INSURED for or on behalf of Skagit PUD; or (b) products sold by the NAMED INSURED to Skagit PUD, or (c) premises leased by the NAMED INSURED used for conducting the work: any other insurance maintained by Skagit PUD, its elected or appointed officers, officials, employees and consultants shall be in excess of this insurance and shall not contribute with it.
3. **SEVERABILITY OF INTEREST.** The inclusion of more than one Insured under this policy shall not affect the rights of any Insured as respects any claim, suit or judgment made or brought by or for any other Insured or by or for any employee of any other insured. This policy shall protect each Insured in the same manner as though a separate policy had been issued to each, except that nothing herein shall operate to increase the company's liability beyond the amount or amounts for which the company would have been liable had only one insured been named.
4. **CANCELLATION NOTICE.** The insurance afforded by this policy shall not be suspended, voided, canceled, reduced in coverage or in limits except after FORTY-FIVE (45) days' prior written notice by certified mail return receipt requested has been given to Skagit PUD. Such notice shall be addressed to the Skagit PUD, 1415 Freeway Drive, Mount Vernon, WA 98273.
5. **CLAIM REPORTING.** Skagit PUD has no obligation to report occurrences unless a claim has been filed with the Owner.
6. **AGGREGATE LIMIT.** The General Aggregate Limit under Limits of Insurance (Section III) applies separately to the above named contract for Skagit PUD.

Authorized Representative

Date

Signature

DRAFT AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « 2023 »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Skagit PUD»«»
«1415 Freeway Drive
Mount Vernon, WA 98273»
«»
«»

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«Skagit PUD Administration Building»
«1415 Freeway Drive, Mount Vernon, WA 98273»
«Construction of a new administration building. »

The Architect:
(Name, legal status, address and other information)

«Driftmier Architects, P.S.»«»
«7983 Leary Way NE
Redmond, WA 98052»
«Telephone Number: 425-881-7506»
«»

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

The parties should complete A101®-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

☐ The date of this Agreement.

☐ A date set forth in a notice to proceed issued by the Owner.

☒ Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

☐ A date set forth in a notice to proceed issued by the Owner. However, activity on the site will not commence until after July 31, 2023. ☐

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

[« X »] Not later than « Four hundred fifty » (« 450 ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

§ 3.5 The Contractor shall achieve Physical Completion of the Work within «Thirty» («30») days following Substantial Completion. Liquidated damages related to the Contractor's failure to obtain Physical Completion on time are as provided in Section 8.4 of the Supplementary Conditions.

§ 3.6 All warranties, guaranties, submittals and final pay application, release of liens, etc., required for final completion shall be submitted to the Owner through the Architect no later than Thirty (30) days following Physical Completion. The Owner will not act on Final Acceptance until all materials required to be furnished by the Contractor have been submitted and approved. Upon Final Acceptance, the Owner will begin the process with the State to release retainage.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » (\$ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

« Liquidated damages related to the Contractor's failure to obtain interim and final dates for Substantial Completion on time are as provided in Section 8.4 of the General Conditions. Physical Completion shall be defined as the point when all physical construction is complete, including all punchlist items. »

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « Twenty-fifth » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « last » day of the « following » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « Sixty » (« 60 ») days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« Per Washington State RWC 60.28 and section 9.3.5 of the Supplementary Conditions 00 7300. »

§ 5.1.7.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

(Insert any other conditions for release of retainage upon Substantial Completion.)

« »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1** the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2** a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

«8.00 » % « per annum »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

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<< >>
<< >>

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

☒ [**X**] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

☐ [**X**] Litigation in a court of competent jurisdiction

☐ [**X**] Other *(Specify)*

<< >>

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner’s convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner’s convenience.)

<< >>

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner’s representative:

(Name, address, email address, and other information)

«George Sidhu»
«1415 Freeway Drive
Mount Vernon, WA 98273»

<<
<<
<<
<<

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

<< >>
<< >>
<< >>
<< >>
<< >>
<< >>

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

<< >>

§ 8.7 Other provisions:

<< >>

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
- .2 .3 AIA Document A201™–2017, General Conditions of the Contract for Construction
- .4

<< >>

- .5 Drawings

Number	Title	Date
As attached Exhibit A		

- .6 Specifications

Section	Title	Date	Pages
Part I	Bidding Requirements and Conditions of the Contract		
Part II	Technical Specifications		

- .7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

- .8** Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[☐ »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« ☐ »

[☐ »] The Sustainability Plan:

Title	Date	Pages

[☐ »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
00 7000	General Conditions		
00 7300	Supplementary Conditions		
00 7700	Special Conditions		

- .9** Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« ☐ »

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

«George Sidhu»«», General Manager

(Printed name and title)

CONTRACTOR (Signature)

« »« »

(Printed name and title)

EXHIBIT A

To the Standard Form of Agreement Between Owner and Contractor for the

SKAGIT PUD

PN 3675 CAMPUS REPLACEMENT ADMINISTRATION BUILDING

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May 23, 2023

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DRAFT AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

«Skagit PUD Administration Building»
«1415 Freeway Drive, Mount Vernon, WA 98273»

THE OWNER:

(Name, legal status and address)

«Skagit PUD»«»
«1415 Freeway Drive
Mount Vernon, WA 98273»

THE ARCHITECT:

(Name, legal status and address)

«Driftmier Architects, P.S.»«»
«7983 Leary Way NE
Redmond, WA 98052»

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For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor’s control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor’s right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

**SUPPLEMENTARY CONDITIONS
SECTION 00 7300**

These Supplementary Conditions amend or supplement the General Conditions of the Contract for Construction, AIA Document A201-2017 edition (referred to below as "AIA Document A201"), as indicated below. All provisions of AIA Document A201 which are not so amended or supplemented remain in full force and effect.

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

Add Subparagraphs 1.1.9 through 1.1.18 to AIA Document A201.

1.1.9 THE PROJECT MANUAL

The project manual is the volume(s) assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract, Technical Specifications, and Supplemental Information.

1.1.10 PHYSICAL COMPLETION

When all of the Work required of the Contractor is physically completed on the Project. All the documentation, required by the Contract Documents and required by law, need not be submitted by the Contractor by this date and the Contractor should not delay Physical Completion for closeout related paperwork.

1.1.11 FINAL COMPLETION/ FINAL ACCEPTANCE

Final Completion is achieved at the time Physical Completion has been reached, all closeout documentation has been submitted and accepted, and the final Certificate of Payment approved by the Architect per Section 9.11.

1.1.12 KNOWLEDGE

The terms "knowledge," "recognize" and "discover," their respective derivations and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows or should know, recognizes or should recognize and discovers or should discover in exercising the care, skill, and diligence of a diligent and prudent contractor familiar with the work. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a diligent and prudent contractor familiar with the work and in accordance with the highest standards in the contracting profession.

1.1.13 CHANGE ORDER

A written order to the Contractor, after execution of the Contract, authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Sum or Contract Time.

1.1.14 CLAIM

A demand or assertion by the Owner or Contractor seeking an adjustment of Contract Price or Contract Time, or both, or other relief with respect to the terms of the Contract Documents. A demand for money or services by a third party is not a Claim.

1.1.15 CONTRACT SUM

The total moneys payable to the Contractor under the terms and conditions of the Contract Documents and further described in Article 4 of AIA101 – 2017 between Owner and Contractor.

1.1.16 CONTRACT TIME

The number of consecutive calendar days stated in the Contract Documents for the completion of the Work and further described in Article 3 of AIA101 – 2017 between Owner and Contractor.

1.1.17 LIQUIDATED DAMAGES

The amount to be paid to the Owner, or to be deducted from any payments due or to become due to Contractor, for each day's delay in completion of Substantial or Physical Completion of the Work beyond the time allowed in the Contract Documents, plus any extensions thereof.

1.1.18 ADDENDA OR ADDENDUM

Any changes or additions made to the Contract Documents by the Owner, prior to acceptance of the Bid and execution of the Agreement.

1.3 CAPITALIZATION

1.3.1 *Add the following to the paragraph on capitalization:*

Although every effort has been made to ensure proper capitalization in this document, the fact that a term which should be capitalized is not capitalized shall have no substantive effect if it is reasonably clear from the context in which the term is used that the term should be capitalized.

ARTICLE 2 - OWNER

2.3 INFORMATION AND SERVICES REQUIRED OF OWNER

2.3.6 *Delete Subparagraph 2.3.6 and replace with the following:*

2.3.6 The Contractor will be furnished free of charge three (3) copies of Drawings and Project Manuals. Two (2) copies of any "in construction" drawings will be furnished to the Contractor without charge. Additional sets shall be furnished at the cost of reproduction, postage and handling.

2.6 *Add the following Paragraph:*

2.6 OWNER'S RIGHT TO AUDIT

2.6 The Contractor shall keep full and accurate records of all costs incurred and items billed in connection with the performance of the Work, which records shall be open to audit by the Owner or its authorized representatives during performance of the Work and until six years after Final Payment. In addition, the Contractor shall make it a condition of all subcontracts relating to the Work that any and all Subcontractors will keep accurate records of costs incurred and items billed in connection with their work until final payment is made.

ARTICLE 3 - CONTRACTOR

3.1 GENERAL

3.1.1.1 *Add the following Subparagraph:*

The Contactor warrants to Owner that it is currently licensed in the jurisdiction where the Project is located to perform the work required by the Contract Documents. If, at any time, the Contractor's license lapses, Contractor shall make every effort to immediately reinstate all required licenses, and Contractor shall be responsible to the Owner for all delay and other costs incurred by Owner as a result of such lapse, including any additional costs of hiring substitute contractors.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.2 Delete Subparagraph 3.2.2 and replace with the following subparagraphs:

3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents.

3.2.2.1 The Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information. The Architect will make the final decisions regarding the design intent and clarity of the construction documents related to the conflicts and omissions. Where conflicts and omissions have not been brought to the Architect's attention, it is understood that the Contractor has figured the most costly method for completing the Work. If Contractor does Work in conflict with another part of Drawings or Specifications before receiving permission from Architect, he must remove all such Work at his own expense as deemed necessary by Architect. After signing the Contract Agreement, no increase in price is allowed for any conflict or for any omissions where the intent, by the decision of the Architect, is established by the character of the Project, similar conditions elsewhere in the Project, or by surrounding conditions.

3.2.2.2 It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless: (a) otherwise specifically provided in the Contract Documents, or (b) for parts of the work designated as "delegated design", "bidder-design", "design build", and similar terms.

3.2.2.3 When submitting a Request For Information, the Contractor shall use the AIA Document G716, or another form with the same content.

3.2.2.4 The Contractor shall allow the Architect 7 days to respond to Requests For Information.

3.2.3 Delete Subparagraph 3.2.3 and replace with the following subparagraphs:

3.2.3 Except as indicated below, the Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities. The Contractor shall promptly report to the Architect, through a request for information, any nonconformity discovered by or made known to the Contractor.

3.2.3.1 Delegated Design: When the Contract Documents indicate that a component or portion of the work includes delegated design (bidder-design, design build, etc.), the Contractor shall be required to provide designs, drawings, etc. that are in compliance with all applicable laws, statutes, ordinances, codes, rules, or regulations of public authorities having jurisdiction (AHJ). For this part of the

work the Contractor or Subcontractor shall coordinate their work with all codes and be responsible for compliance.

3.2.5 *Add the following Subparagraph:*

3.2.5 The Contractor acknowledges and warrants that it has closely examined all the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the Work in a timely manner for the Contract Sum, and that they include all work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable codes, laws, ordinances, and regulations.

3.4 LABOR AND MATERIALS

3.4.2 *The following shall be added to existing Subparagraph 3.4.2:*

After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements. Substitutions include all evaluations of comparable products or systems associated with semi-proprietary specifications, basis of design and named products and systems. By making the request for substitutions based on Subparagraph 3.4.2 above, the Contractor:

3.4.2 *Add new Subparagraphs 3.4.2.1, 3.4.2.2, 3.4.2.3 & 3.4.2.4 as follows:*

- .1 Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
- .2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
- .3 Certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
- .4 Will coordinate the installation of the accepted substitute, making such changes as may be required by the Work to be complete in all respects.

3.5 WARRANTY

3.5.1.1 *The following shall be added as a Subparagraph to 3.5.1 and shall comprise the concluding sentences thereof:*

"Materials and equipment...of good quality and new", as referenced above in this Subparagraph, means that all such materials and equipment shall be in current production at time of bidding. No discontinued lines, patterns or colors will be permitted unless approved in writing by Owner.

3.7 PERMITS, FEES AND NOTICES

3.7.1 *Delete Subparagraph 3.7.1. This paragraph has been moved to Special Conditions. See division 00 7700 Special Conditions.*

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

3.10 *Add the following subparagraphs:*

3.10.2.1 The Architect shall be allowed 14 days for the review of each submittal and resubmittal. The Architect shall be allowed 21 days of each sequential review of submittals.

3.10.4 Daily Construction Reports: Contractor shall record daily construction activities in daily reports. Contractor shall submit reports upon request to Architect or Owner. Record shall include the following information concerning events at Project site as appropriate:

- .1 List of subcontractors at Project site; approximate count of personnel at Project site, equipment at Project site; material deliveries; high and low temperatures and general weather conditions; including presence of rain or snow; accidents and emergencies; meetings and significant decisions; unusual events; stoppages, delays, shortages, and losses; orders and requests of authorities having jurisdiction; services connected and disconnected, equipment or system tests and startups.

3.10.5 Float is the measure of leeway in starting and completing an activity. Float time belongs to Owner. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

3.18 INDEMNIFICATION

Subparagraphs 3.18.1, and 3.18.2 of AIA Document A201 are each deleted and the following substituted therefor:

3.18.1 Contractor shall defend, indemnify and save harmless the Owner, the Architect, and each of their officers, employees and agents, from any and every claim and risk and all losses, damages, demands, suits, judgments and attorney fees, and other expenses of any kind, on account of injury to or death of any and all persons and/or on account of all property damage of any kind, whether tangible or intangible, including loss of use resulting therefrom, in connection with the work performed under this Contract, or caused or occasioned in whole or in part by reason of the presence of the Contractor or its Subcontractors, or their property, employees or agents, upon or in proximity to the property of the Owner, or any other property upon which the Contractor is performing any work called for or in connection with this Contract, except only for those losses resulting solely from the negligence of the Owner, the Architect, or their officers, employees and agents.

3.18.2 Should a court of competent jurisdiction determine that this Agreement is subject to RCW 4.24.115, then in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Contractor and the Owner, the Architect, or their members, officers, employees and agents, the Contractor's liability hereunder shall be only to the extent of the Contractor's negligence. It is further specifically and expressly understood that the indemnification provided herein constitutes Contractor's waiver of immunity under industrial insurance, Title 51 RCW, solely for the purposes of this indemnification. This waiver has been mutually negotiated by the parties.

3.18.3 If a lawsuit arises in respect to this hold harmless provision, the Contractor shall appear and defend the lawsuit at its own cost and expense, and if judgment is rendered or settlement made requiring payment of damages by the Owner, the Architect, or their officers, agents, employees and volunteers, the Contractor shall pay the same.

3.18.4 Contractor's obligations under this paragraph shall survive expiration or termination of the Contract and includes, but is not limited to, all claims against the Owner by an employee or former employee of the Contractor or any Subcontractor. For this purpose, the Contractor expressly waives, as respects to the Owner only, all immunity and limitation on liability under any Industrial

Insurance Act, including Title 51 RCW, or other worker's compensation act, disability act, or other employee benefit of any act of any jurisdiction which would otherwise be applicable in the case of such a claim. **BY SIGNING THE AGREEMENT THE OWNER AND CONTRACTOR CERTIFY THE WAIVER OF IMMUNITY SPECIFIED BY THIS PROVISION WAS MUTUALLY NEGOTIATED.**

ARTICLE 4 - ARCHITECT

4.1 ARCHITECT

4.1.3 Add a new Subparagraph 4.1.3 as follows:

The Owner may, at Owner's sole discretion, employ a 'Construction Inspector' or 'Clerk of the Works' under the Architect, or separate from the Architect, to assist the Owner and/or Architect with administration, inspections, or similar functions. The duties of this entity or individual will be established at Commencement and may be modified upon agreement of the Owner and Architect.

4.2 ADMINISTRATION OF THE CONTRACT

4.2.7.1 Add a new Subparagraph 4.2.7.1 as follows:

The Architect shall be allowed 14 days for the review of each submittal and resubmittal. The Architect shall be allowed 21 days of each sequential review of submittals.

4.2.11 Add the following to the end of Subparagraph 4.2.11 as follows:

If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

ARTICLE 5 -SUBCONTRACTORS

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.2 Delete the reference to "30 days" in Subparagraph 5.4.2 of AIA Document A201 and replace with "90 days".

5.4.3 Delete sentence that reads, " If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract".

5.5 Add the following title and subparagraphs:

5.5 OWNER PAYMENTS TO SUBCONTRACTORS

5.5.1 In the event of any default hereunder by the Contractor, or in the event the Owner fails to approve any Application for Payment that is not the fault of a Subcontractor, the Owner may make direct payment to the Subcontractor, less appropriate retainage. In that event, the amount so paid the Subcontractor shall be deducted from the payment to the Contractor.

5.5.2 Nothing contained herein shall create any obligation on the part of the Owner to make any payments to any Subcontractor, and no payment by the Owner to any Subcontractor shall create any obligation to make any further payments to any Subcontractor.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.4 Delete Subparagraph 6.1.4 of AIA Document A201.

6.2 MUTUAL RESPONSIBILITY

6.2.4 Delete the clause "as provided in Subparagraph 10.2.5" appearing at the end of Subparagraph 6.2.4 of AIA Document A201.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

7.1 Add New Subparagraphs 7.1.4 and 7.1.5 as follows:

7.1.4 For any changes in the Work involving a request by the Contractor of more than a three (3) calendar day extension of time, the Contractor shall submit critical path schedules showing the original schedule and the impact of the proposed change justifying the requested extension of time. The Owner may at its option refuse the extension of time and have the Contractor perform the work within the original schedule, provided all reasonable costs for completing the work, including overtime and acceleration costs, are included in the Change Order.

7.1.5 If the Owner requests from the Contractor a proposal for additional work which involves additional cost and time, at the Owner's option the Owner may extend the completion date for the additional work only without extending the Project completion date, provided costs are included in the Change Order to compensate the Contractor for reasonable remobilization costs.

7.2 CHANGE ORDERS

7.2.2 Add New Subparagraph 7.2.2 as follows:

7.2.2 Unless otherwise agreed to by Owner, Change Order cost adjustments shall be calculated in conformance with Section 7.3. as amended.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.4 Delete the last sentence of Subparagraph 7.3.4 of AIA Document A201 ("Unless otherwise provided in the Contract Documents..."), including Clauses 7.3.4.1, .2, .3, .4, and .5 thereof, and substitute the following therefor:

Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 7.3.4 may include the following:

- .1* Wages of construction workers directly employed by the Contractor to perform the construction of the Change Order, including welfare, unemployment compensation, social security and other benefits;
- .2* Contractor's Project Manager's time spent on coordinating Change Order Proposals up to (1) hour. Time in excess to (1) hour must be approved by Owner in advance;
- .3* Costs, including transportation, of materials and equipment incorporated or to be incorporated in the completed construction;
- .4* Payments made by the Contractor to Subcontractors for work necessary to the completion of the Change Order. Subcontractor overhead and profit mark-up shall be the same as outlined in 7.3.4.9;

- .5 Cost of all materials, equipment and hand tools not customarily owned by the construction workers, which are provided by the Contractor and fully consumed in the performance of the Change Order;
- .6 Reasonable rental costs for necessary machinery, equipment, and hand tools used at the site of the Work, when rented from a recognized business not a party to this Contract. Rates and quantities of equipment rented shall be subject to the Owner's prior approval;
- .7 Cost of value-based bond and insurance premiums, permit fees, sales/use and similar taxes related to the Work;
- .8 Costs of removal of debris caused by the Change Order from the site;
- .9 An amount for overhead and profit not to exceed ten percent (10%) of actual labor and materials costs for the first \$50,000 and four percent (4%) of the remaining cost, if any;
- .10 An amount for markup on the amount due to subcontractors not to exceed four percent (4%) for the first \$50,000 and two percent (2%) of the remaining cost, if any;
- .11 An amount for direct supervision not to exceed fifteen percent (15%) of the direct labor costs;
- .12 An amount for safety not to exceed two percent (2%) of the direct labor and supervision costs;
- .13 An amount for small tools, which are tools that cost \$250 or less and are normally furnished by the contractor, that does not exceed 2% of direct labor costs;
- .14 An amount for insurance not to exceed one percent (1%), unless approved by the Owner;
- .15 An amount for Bond premiums not to exceed one percent (1%), unless approved by the Owner; and
- .16 Other costs incurred in the performance of the Work if and to the extent approved in advance in writing by the Owner.

7.3.5 *Delete Subparagraph 7.3.5 of AIA Document A201 and substitute the following:*

Costs for Construction Change Directives and Change Orders shall not include:

- .1 Salaries and other compensation of the Contractor's personnel stationed at the Contractor's principal office or offices other than the site office except as may be provided in Section 7.3.4;
- .2 Expenses of the Contractor's principal office and offices other than the site office;
- .3 Overhead and general expenses, except as may be expressly included in Section 7.3.4;
- .4 The Contractor's capital expenses, including interest on the Contractor's capital employed for the Work;
- .5 Rental costs of machinery and equipment, except as specifically provided in Section 7.3.4;
- .6 Costs due to the fault or negligence of the Contractor, Subcontractors, anyone directly or indirectly employed by any of them, or for whose acts any of them may

be liable, including, but not limited to, costs for the correction of damaged, defective or nonconforming Work, disposal and replacement of materials and equipment incorrectly ordered or supplied, and making good damage to property not forming part of the Work; or

.7 Any cost not specifically and expressly described in Section 7.3.4.

7.3.11 *Add New Subparagraph 7.3.11 as follows:*

If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in the accordance with applicable provisions of Article 15.

7.4 MINOR CHANGES IN THE WORK

7.4 *Add the follow to the end of Paragraph 7.4 as follows:*

An “Architect’s Supplemental Instruction” or “Minor Work Authorization” authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions or in similar letter format.

7.5 *Add the follow section:*

7.5 CHANGE ORDER PROPOSALS AND CHANGES ORDER PROPOSAL REQUESTS

7.5.1 Owner-Initiated Change Order Proposal Requests (COPR): Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.

- .1 Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress, or to execute the proposed change.
- .2 Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit a Change Order Proposal (COP) that includes an estimate of cost necessary to execute the proposed change.
 - .1 Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - .2 Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - .3 Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
 - .4 Include a statement indicating the effect the proposed change on other Work in place or planned. Include costs and credits for all such coordination of work items.
 - .5 Cost included are to comply with the requirements of 7.3.4 and 7.3.5.

7.5.2 Contractor-Initiated Change Order Proposals: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a Change Order Proposal (COP).

- .1 Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change, including impacts on any other building systems, components and materials. Indicate the effect of the proposed change on the Contract Sum and Contract Time, indicate if the change will likely require consultant redesign time.
- .2 Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities and supporting estimating data on hours and materials needed.
- .3 If the cost associated with change is indeterminate, Contractor shall request a Construction Change Directive.
- .4 Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- .5 Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
- .6 Indicate compliance with Contract requirements for profit, overhead and other markups.
- .7 Cost included are to comply with the requirements of 7.3.4 and 7.3.5.

7.5.3 Change Order Proposal Request Form: AIA Document G 709 for Change Order Proposal Requests or similar letter format.

ARTICLE 8 - TIME

A new Paragraph 8.4 and new Subparagraphs 8.4.1 through 8.4.5 shall be added, reading as follows:

8.4 LIQUIDATED DAMAGES

- 8.4.1 It is agreed by the parties to the Contract that time is of the essence; and that in case all the Work is not completed before or upon the expiration of the time limit as set forth, damage will be sustained by the Owner; and that it may be impracticable to determine the actual amount of damage by reason of such delay; and it is, therefore, agreed that the Contractor will pay to the Owner the amount per calendar day stated herein for each and every day the Work remains uncompleted after expiration of the specified time for Substantial Completion, as representing a reasonable forecast of the actual damages which the Owner will suffer by failure of the Contractor to complete the Work within the stipulated time. Occupancy under partial substantial completion does not terminate the application of liquidated damages if in fact the project is not completed prior to or on the date of contracted substantial completion.
- 8.4.2 Liquidated damages shall apply if Contractor fails to reach either or both Substantial Completion or Physical Completion within the time specified for such completion. Liquidated damages shall be \$2500.00 per calendar day for failure to reach Substantial Completion and \$500.00 per calendar day for failure to reach Physical Completion within the specified time following Substantial Completion.
- 8.4.3 The execution of this Agreement shall constitute acknowledgment by the Contractor that he has ascertained and agrees that the Owner will actually suffer damages in the amount herein fixed for each day during which the completion of the Work is delayed beyond the stipulated completion date. In the event of the failure of the Contractor to complete the Work within the time limit in the Contract, or within such further times as the Owner grants, the Owner may then relet the Contract for the unfinished portions of the Work or

complete it and charge the Contractor for the costs incurred thereby. Such reletting or doing said Work shall not relieve the original Contractor or his sureties from liabilities on their bonds.

- 8.4.4 The liquidated damages do not include and are in addition to damages from costs for architectural, engineering, administrative, and other costs incurred beyond contract completion dates. The cost of additional office and field architectural services, engineering, construction surveillance, and other costs related to the physical construction of the project beyond the Physical Completion date shall be reimbursed to the Owner by the Contractor at standard billing rates for said services then in effect. Costs related to the review and processing of closeout documents beyond the initial review of closeout documents by Owner's consultants will be reimbursed to Owner by Contractor at standard billing rates.
- 8.4.5 It is agreed by both parties that the contract time for the Contractor to reach substantial completion as shown in the Owner/Contractor's Agreement is the schedule for the project. The Contractor will provide a schedule that anticipates work sequencing and completion dates for various portions of the work. However, for the purposes of the contract, extensions in time, claims for delay, other claims, and similar adjustments, contract schedule will show substantial completion as of the last date allowed under the contract time as stated in the contract. The contract time as included in the contract will be the only schedule to be considered.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.3 APPLICATIONS FOR PAYMENT

9.3.1 *Delete Subparagraph 9.3.1 and Subparagraphs 9.3.1.1 and 9.3.1.2 of AIA Document A201 and substitute the following therefor:*

9.3.1 Before the date established for each progress payment, as provided in the Contract, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage as required herein, by RCW Chapter 60.28 or other applicable law.

9.3.1.1 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.

9.3.1.2 Reference is made to Division 01 Section "Payment Procedures" for additional requirements for pay applications.

New Subparagraphs 9.3.4 through 9.3.7 shall be added to AIA Document A201, reading as follows:

9.3.4 Such applications shall be accompanied by an updated progress schedule, and by partial lien releases executed by all Subcontractors, mechanics and materialmen who supplied labor or materials or both in the performance of Work for which progress payments were previously made. Applications not accompanied by an updated progress schedule may be denied as incomplete. The first application on public works projects shall be preceded by submission of State approved "Notice of Intent to Pay Prevailing Wages" from every contractor and subcontract at all levels per state law.

9.3.5 The Architect or Owner may request the Contractor to provide data substantiating the Contractor's right to payment, including, without limitation:

- .1 Copies of requisitions from Subcontractors;

- .2 lien releases;
- .3 certified payroll records for Contractor and all major Subcontractors;
- .4 retainage documentation; and
- .5 other documentation as provided elsewhere in the Contract Documents.

9.3.6 For public works projects in the State of Washington, the Owner shall retain from payments earned by the Contractor a sum equal to five percent (5%) of the amount earned in accordance with RCW Chapter 60.28. The retainage shall be held as a trust fund for the protection and payment of any person or persons, mechanic, Subcontractor, or materialman who shall perform any labor under this Contract, and all persons who shall provide supplies for the carrying on of such Work, as well as the State of Washington with respect to taxes imposed pursuant to RCW Title 82 which may be due from Contractor. Said trust fund shall be retained for the statutory period, and released as required by law, after receipt of a clearance of the Department of Revenue, Department of Labor & Industries, and all liens and claims.

- .1 The Contractor may withhold from Contractor's payments to its Subcontractors and Suppliers not more than 5% as retainage from moneys earned by such persons or entities.
- .2 Monies reserved under provisions of Chapter 60.28 RCW shall, at the option of the Contractor, be managed as stated below. By choosing option b or c interest will be paid to the Contractor, but the Contractor agrees to assume full responsibility to pay all costs which may accrue from escrow services, brokerage charges, or both, and further agrees to assume all risks in connection with the investment of the retained monies. The retainage funds shall be:
 - a. Retained in a fund by the Owner with no interest paid thereon to the Contractor
 - b. Deposited by the Owner in an interest-bearing account in a bank, mutual savings bank, or savings and loan association, not subject to withdrawal until after final acceptance of all work.

9.3.7 Contractor shall use the AIA Documents G702 and 703 when submitting for payment, or a form approved in writing by the Architect. A cover page shall also be required for the pay application in the Owner's format.

9.4 CERTIFICATES FOR PAYMENT

9.4.2.1 Add an new Subparagraph 9.4.2.1 following Paragraph 9.4.2 of AIA Document A201 stating the following:

- 9.4.2.1 Due to the foregoing, on progress pay applications prior to Substantial Completion the Architect is under no obligation to certify, nor the Owner to pay, more than 95% of any or all line items in the Schedule of Values.

9.6 PROGRESS PAYMENTS

9.6.3 Add to existing Subparagraph 9.6.3 of AIA Document A201, the following:

The foregoing provision shall be construed solely for the benefit of the Owner and will not require the Owner or Architect to determine or adjust any claims or disputes between the Contractor and Subcontractor or material dealers, or to withhold any monies for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any monies from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this contract.

9.7 FAILURE OF PAYMENT

9.7 *Delete Paragraph 9.7 of AIA Document A201.*

9.8 SUBSTANTIAL COMPLETION

9.8.1 *Add to existing Subparagraph 9.8.1 of AIA Document A201, so that it reads:*

...intended use and when all required occupancy permits have been issued and copies of same have been delivered to Owner.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.3 *Delete Subparagraph 9.10.3 of AIA Document A201 and replace with the following:*

9.10.3 Owner shall be obligated to make only one final payment to Contractor after Substantial Completion.

9.10.4 *Delete Subparagraph 9.10.4 of AIA Document A201 and substitute the following:*

9.10.4 The making of final payment shall not constitute a waiver of any Claims by the Owner.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1 *Delete Paragraph under 10.1 of AIA Document A201 and substitute the following Paragraph and Subparagraphs therefor:*

10.1 In accordance with generally accepted construction practices and state law, the Contractor shall be solely and completely responsible for safety conditions on the job site, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and not be limited to normal working hours.

10.1.1 The services of the Owner's or Architect's personnel in conducting construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's work methods, equipment, bracing or scaffolding, or safety measures in, on, or near the construction site.

10.1.2 The Contractor is hereby informed that work on this project could be hazardous. The Contractor shall carefully instruct all personnel working in potentially hazardous work areas as to potential dangers and shall provide such necessary safety equipment and instructions as are necessary or required by law to prevent injury to personnel and damage to property. Special care shall be exercised relative to work underground.

10.1.3 All work and materials shall be in strict accordance with all applicable state, city, county, and federal laws, regulations, ordinances, order and codes. Attention is drawn to the requirements of WISHA, the Washington Industrial Safety & Health Act, RCW Chapter 49.17. The Contractor shall be solely responsible for compliance with all city, county, state and federal laws, regulations, ordinances, orders and codes for any damages caused by his operations.

10.1.4 The Contractor shall obtain all permits not obtained by the Owner for all work subject to the requirements thereof. This in no way relieves the Contractor from the requirement of maintaining safety in all operations performed by him or his Subcontractors.

- 10.1.5 Notwithstanding any classifications relative to the Tunnel Safety Orders, work within confined spaces on this project is subject to the definitions and applicable provisions of the Washington Administrative Code. In addition, the contractor will comply with all Trench Safety rules and regulations of Chapter 49.17 RCW, Washington Industrial Safety and Health Act.
- 10.1.6 The Contractor shall perform its work so as not to expose personnel to or to discharge into the atmosphere from any source whatever, smoke, dust, asbestos, toxic chemicals, or other air contaminants in violation of the laws, rules, and regulations of the governmental entities having jurisdiction.
- 10.1.7 Nothing in the Specifications is to be construed to permit work not conforming to governing codes. When Contract Documents differ from governing codes, the Contractor shall furnish and install the higher standards called for without extra charge. All equipment furnished shall be grounded and provided with guards and protection as required by safety codes. Where vapor tight or explosion-proof electrical installation is required by code, this shall be provided.
- 10.1.8 At his expense, the Contractor shall provide first aid cabinets stocked with proper dressings, antiseptics and medical equipment near all points where men are at work and shall promptly furnish proper first aid to sick or injured persons on the premises.
- 10.1.9 No blasting shall be done related to the Work or in or about the job site without the prior written authorization of the Owner. In conducting any blasting, the Contractor shall comply with all laws, ordinances, regulations, codes, and orders governing the transportation, storage, and use of explosives, shall exercise extreme care not to endanger life or property, and shall be responsible for all injury or damage resulting from the use of explosives for or on the Work or in or about the job site. No blasting shall be done in the vicinity of existing structures above or below ground without prior written consent of the Owner thereof. Contractor shall be solely responsible for any damages caused by his blasting operations.
- 10.1.10 The Contractor shall provide safe access for the Owner and its inspectors to adequately inspect the quality of work and the conformance with project Specifications. The Contractor shall provide adequate lighting, ventilation, ladders and other protective facilities as may be necessary for the safe performance of inspections.
- 10.1.11 No part of the Work on new and existing structures, scaffolding, shoring, sheeting, construction machinery and equipment, or other permanent and temporary facilities shall be loaded with weights or subjected to stresses or pressures that endanger any of them. The Contractor shall bear the cost of correcting damage caused by overloading or excessive stresses or pressures.

10.2 SAFETY OF PERSONS AND PROPERTY

Delete Paragraph 10.2 and Subparagraphs 10.2.1 through and including 10.2.8 of AIA Document A201.

10.3 HAZARDOUS MATERIALS

10.3.4 Delete Paragraph 10.3.4 of AIA Document A201 and the following substituted therefor:

10.3.4 The Owner shall not be responsible under this Section 10.3 for materials, substances, products, assemblies and components the Contractor brings to the site. The Contractor is solely responsible for conducting the work so as to prevent the importation or development of hazardous materials or conditions within the work under the contract. This specifically includes, but is not limited to, environmental hazards such as mold, mildew, decay, and chemicals. The Contractor shall employ preventative means, methods and protective measures to prevent the development or incorporation of hazardous materials and environmental hazards in the work and on the project site. Failure to do so constitutes negligence on the part of the Contractor.

10.3.5 Delete Paragraph 10.3.5 of AIA Document A201 and the following substituted therefor:

10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs for hazardous material or conditions remediation associated with (1) materials, substances, components, etc. brought to the site by the Contractor or are mishandled by the contractor, (2) that develop as a result of Contractor negligence in conducting the work, (3) where the Contractor fails to perform its obligations under the Contract Documents, and (4) when the Contractor fails to act in accordance with Sections 10.3.1 or 10.3.4.

ARTICLE 11 - INSURANCE AND BONDS

Delete Paragraphs 11.1, 11.2, 11.3, and 11.4, together with all Subparagraphs thereof, of AIA Document A201. This paragraph has been moved to Special Conditions. See division 00 7700 Special Conditions.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.2.2 AFTER SUBSTANTIAL COMPLETION

12.2.2.1 *Replace the words "Substantial Completion" with the words "Final Acceptance". The one year period for correction of Work shall be from the date of Final Acceptance.*

12.2.2.2 *Replace the words "Substantial Completion" with the words "Final Acceptance". The one year period for correction of Work shall be from the date of Final Acceptance.*

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Add new Subparagraphs 13.1.2 through and including 13.1.10 to AIA Document A201, reading as follows:

13.1.2 COMPLIANCE. The Contractor shall inform himself of all laws, ordinances, codes, rules and regulations in any manner affecting those employed on the Work, or the materials used in the Work, or in any way affecting the conduct of the Work, and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the Work. He shall at all times himself give all notices and observe and comply with, and shall require all agents, employees, Subcontractors, and Sub-subcontractors to observe and comply with all such applicable laws, ordinances, rules, regulations, orders, and decrees in effect or which may become effective before completion and acceptance of the Work; and shall protect and indemnify the Owner and Architect against any claim of liability arising from or based upon the violation of any such law, ordinance, code, rule regulation, order, or decree, whether by himself, his employees, or his Subcontractors or Sub-subcontractors, or any other person or organization employed for or upon the Work. If the Contractor observes that any requirement of the Contract Documents is at variance with such laws, ordinances, codes, rules, regulations, orders, or decrees, he shall promptly notify the Architect in writing and shall not proceed with any Work affected by such variance without the Architect's written instructions or the issuances of appropriate clarification.

13.1.3 PROVISIONS OF LAW DEEMED INSERTED. Each and every provision of law required by law to be inserted in the Contract Documents shall be deemed to be inserted and the Contract Documents shall be read and enforced as though it were included.

13.1.4 INDUSTRIAL SAFETY AND HEALTH. The Contractor shall at all times comply with the provisions of RCW Chapter 49.17 "WASHINGTON INDUSTRIAL SAFETY AND HEALTH ACT".

13.1.4.1 ACCIDENT PREVENTION. Precaution shall be exercised at all times by the Contractor for the protection of persons, employees and property. The safety provisions of applicable laws and local building and construction codes shall be observed. The operations of the Contractor for the protection of person, and for guarding against hazards of machinery and equipment, shall meet the requirements of State law and all safety regulations as set out in "Safety Standards for Construction" and "General Safety Standards". These publications may be obtained from the Department of Labor and Industries, Olympia, Washington.

13.1.4.2 PROTECTION OF WORKMEN AND PROPERTY. The Contractor shall erect and maintain good and sufficient guards, barricades and signals at all unsafe places at or near the work, and shall in all cases maintain safe passageways at all road crossings, crosswalks, streets, intersections, and shall do all other things necessary to prevent accident or loss of any kind.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 Delete the reference to "30 days" in Subparagraph 14.1.1 and substitute with "60 days" therefor.

14.1.1.3 Delete Subparagraph 14.1.1.3.

14.1.1.4 Delete Subparagraph 14.1.1.4.

14.1.3 Delete portion of the paragraph so that it reads:

If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit.

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 Delete Clause 14.2.1.4 of AIA Document A201.

14.2.1 Add new Clauses 14.2.1.4 through and including 14.2.1.7 to AIA Document A201, reading as follows:

- .4 disregards the instructions of Architect or Owner (when such instructions are based on the requirements of the Contract Documents);*
- .5 is adjudged a bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act, or to reorganize under bankruptcy or similar laws;*
- .6 otherwise does not fully comply with the Contract Documents; or*

.7 materially breaches the Contract.

14.4 TERMINATION BY OWNER FOR CONVENIENCE

Delete the existing Paragraph 14.4 and all Subparagraphs from AIA Document A201, and replace with the following:

14.4.1 The Owner may terminate the Contract, in whole or in part, without cause, whenever:

14.4.1.1 The Contractor is prevented from proceeding with the Work due to issuance of an order of court or other public authority having jurisdiction; or

14.4.1.2 The Owner reasonably determines that such termination is in the best interests of the Owner.

14.4.2 Whenever the Contract is terminated in accordance with Subparagraph 14.4.1, payment will be made for the actual work performed at the bid contract prices for completed items of work. An equitable adjustment for partially completed items of work and disposal of materials will be made as follows:

14.4.2.1 Payment will be made for partially completed items as mutually agreed. If the Owner and Contractor cannot agree, the Architect will determine the amount of equitable adjustment to be made based upon reasonable means to establish costs. The Contractor shall submit to the Architect copies of invoices, subcontracts, receipts, accounting statements, etc. as necessary to support the Contractor's payment request.

14.4.2.2 To the extent not paid for by the Contract bid prices for completed items of work, Owner will pay as part of the equitable adjustment those direct costs necessarily and actually incurred by the Contractor in anticipation of performing work that has been terminated.

14.4.2.3 The total payment for any one item in the case of a partial termination shall not exceed the bid price as modified by Change Order or Construction Change Directive, less the estimated cost (including overhead and profit) to complete the work and less any amount paid to the Contractor for the item.

14.4.2.4 The total payment where the Contract is terminated in its entirety shall not exceed the total contract price as modified by Change Orders or Construction Change Directive, less those amounts paid to the Contractor before the effective date of the termination.

14.4.2.5 No claim for damages of any kind or for loss of anticipated profits on terminated work will be allowed because of the termination order.

14.4.2.6 Acceptable materials ordered by the Contractor prior to the date work was terminated will either be purchased from the Contractor by the Owner at the actual cost and shall become the property of the Owner, or the Owner will reimburse the Contractor for the actual costs connected with returning those materials to the suppliers.

14.4.3 Delete portion of the paragraph so that it reads:

In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination.

ARTICLE 15 – CLAIMS AND DISPUTES

15.1 CLAIMS

15.1.5 CLAIMS FOR ADDITIONAL TIME

15.1.5.3 Add a new Clause 15.1.5.3 to Subparagraph 15.1.5, reading as follows:

15.1.5.3 It is expressly understood and agreed between the Owner and the Contractor, that the contract time for completion of the work is a reasonable time. The time includes time loss due to inclement weather, taking into consideration the normal climatic conditions, as well as economic and other factors prevailing in the locality of the work.

15.1.5.4 Add a new Clause 15.1.5.4 to Subparagraph 15.1.5, reading as follows:

15.1.5.4 The Contractor may choose at his/her option to utilize a schedule that uses less time than that set out in the Contract as the Contract time. However, for purposes related to all claims, claims for delay, and similar extensions of time, the Contract time for Substantial Completion shall be the only time to be considered. The Contractor's alternate date of Substantial Completion shall not be used.

15.1.5.5 Add a new Clause 15.1.5.5 to Subparagraph 15.1.5, reading as follows:

15.1.5.5 Contractor Substantiation of the Delay: The Contractor must establish specific delay events that are beyond his/her control or responsibility under the Contract. These events must be characterized into those resulting from events under the control of the Contractor and those resulting from parties or events beyond the control of the Contractor (Owner, consultants, weather, local jurisdiction, etc.). Claims for delay events shall be supported by a Critical Path Method (CPM) schedule analysis that demonstrates that the delay event(s) under consideration was both on the critical path and that it was due to factors beyond the control of the Contractor. Distinguish between critical path delay events that are concurrent with Contractor controlled delay events and those that are non-concurrent. Costs related to delay events may be included in the claim if substantiated as having caused actual damage to the Contractor. The Contractor may not claim monetary costs associated with delay events for which the Contractor is responsible, nor for those that are not on the critical path. If responsibility for the delay is shared between Owner and Contractor, the only costs for that time attributable to the Owner or other causes beyond Contractor's control, as determined by the Initial Decision Maker, shall be included in the claim.

15.4 ARBITRATION

15.4.4 CONSOLIDATION OR JOINDER

Delete the existing Paragraphs 15.4.4.1 through 15.4.4.3 from AIA Document A201, and replace with the following:

15.4.4.1 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract shall include, by consolidation or joinder or in any other manner, the Architect, the Architect's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Architect, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Contractor, a separate contractor as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the Owner, Contractor or a separate contractor as described in Article 6 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a Claim not described therein or with a person or entity not named or described therein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

END OF SECTION

ARTICLE 1 - SPECIAL CONDITIONS

1.1 SPECIAL CONDITIONS

1.1.1 Additional Definitions. The word "Architect" as used herein shall mean Driftmire Architects, P.S., 7983 Leary Way NE, Redmond, WA 98052. The word "Owner" as used herein shall mean Skagit PUD.

1.1.2 "As directed" means "As directed by the Architect." Where the words "or approved" or "as approved" or "for approval" are used, the Architect and/or his agent is the sole judge of the quality and suitability of the proposed substitutions. The word "furnish" as used herein shall mean "purchase, pay for, receive and/or store" the material, item or equipment at the site ready for installation or erection, unless otherwise specifically noted. The word "install" as used herein shall mean "pay for, and do all work necessary for installing and/or erecting and/or connecting the item or material complete in place," unless otherwise specifically noted. The words "similar to" are used and followed by a manufacturer's name and/or product model or type number; such manufacturer, product model or type number shall be considered as the standard of quality for the item or material or work specified.

1.1.3 Number of Specified Items Required. Wherever in these specifications an article, device, or piece of equipment is referred to in the singular number, such reference shall include as many such articles as are shown on drawings or required to complete the installation.

ARTICLE 2 – OWNER

2.1 GENERAL CONSTRUCTION

2.1.1 Lands by Contractor. The Contractor shall provide at his own expense and with no liability to the Owner any additional land and access thereto, not shown on the Contract Drawings or described in the Specifications that may be required for temporary construction facilities or storage of materials. The Contractor shall confine his equipment, storage of materials and operation of his workmen to those areas described in the Contract Drawings and Specifications and such additional areas as he provided at his own expense. The Owner and/or Architect will not assume any responsibility for the security or protection of any materials and equipment stored on the site or elsewhere by the Contractor.

2.1.2 Employees. The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ or continue to employ anyone not skilled in the work assigned to him or any person unsatisfactory to the Owner.

2.1.3 Protection of Property.

- 2.1.3.1** The Contractor shall continuously maintain adequate protection of all his construction, the Owner's property, and adjacent public and private property from damage, injury, or loss arising in connection with the Contract. Contractor's responsibility to protect the work continues from contract execution to completion or termination. Contractor's responsibility is not diminished due to delays or extensions no matter what the cause. The Contractor shall make good any damage, injury or loss resulting from lack of adequate protection.
- 2.1.3.2** The Contractor shall not enter upon public or private property for any purpose without obtaining permission from the proper public authority or private property owner.
- 2.1.3.3** Wherever construction under the Contract is undertaken on easements or rights-of-way over private property, or public right-of-way or franchise, all construction operations shall be confined to the limits of such easement, right-of-way, or franchise.
- 2.1.3.4** The Contractor shall protect and maintain all underground or above ground utilities and structures affected by the construction and all fences, and other improvements on property crossed by or adjacent to his operations, and any damage shall be repaired and restored by the Contractor at his expense in a satisfactory manner. The Contractor will be held responsible for all damages caused by his construction to roads, trails, docks, ditches, walls, bridges, culverts, utilities, barricades, lights or other property, whether such damage be at the project site or caused by transporting or hauling to or from the site, and he shall repair or replace at his own expense all such damage in a satisfactory manner.

ARTICLE 3 – CONTRACTOR

3.1 PREVAILING WAGE REQUIREMENTS

- 3.1.1** Prevailing wages shall be paid to all workers, laborers, or mechanics per RCW Chapter 39:12, RCW.
- 3.1.2** The Contractor is responsible for obtaining and paying prevailing wages according to the current schedule from the State Department of Labor and Industries.
- 3.1.3** Current Washington State Prevailing Wage Rates for Public Works Contracts for **Skagit County** can be obtained online at:
- <http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp>
- 3.1.4** Contractor shall follow procedures in RCW 39.12.040 for the provision of Statement of Intent to Pay Prevailing Wages, Affidavit of Wages Paid, Duties of public agencies, Approvals and Prerequisite to payment. The Contractor and each

subcontractor shall pay any and all fees associated with the provision or filing of the Statement of Intent to Pay Prevailing Wages and the Affidavit of Wages Paid.

3.1.4.1 Before payment is made by Owner on account of a public works contract, it shall be the duty of the person charged with the custody and disbursement of public funds to require the contractor and each and every subcontractor from the contractor or a subcontractor to submit a "Statement of Intent to Pay Prevailing Wages." Each statement of intent to pay prevailing wages must be approved by the industrial statistician of the department of labor and industries before it is submitted to the Owner.

3.1.4.2 Prior to final acceptance of a public works project, the contractor and each and every subcontractor shall submit an "Affidavit of Wages Paid" before the funds retained according to the provisions of RCW 60.28.010 are released to the contractor. Each affidavit of wages paid must be certified by the industrial statistician of the department of labor and industries.

3.1.5 Audits. Owner may inspect or audit the Contractor's wage and payroll records to ensure compliance with State law.

3.1.6 Miscellaneous Provisions: The contractor and each subcontractor shall follow the rules and regulations promulgated by the Department of Labor and Industries regarding prevailing wages. These include, but are not limited to:

- .1** Posting requirements;
- .2** Disputes regarding Prevailing Wages;
- .3** Applicability of apprenticeship programs.

3.2 OTHER STATE REQUIREMENTS

3.2.1 Worker's Benefits. The Contractor shall make all payments required for unemployment compensation under Title 50 RCW and for industrial insurance and medical aid required under Title 51 RCW.

3.2.1.1 After physical completion of the project, the Contractor shall submit a "Request for Release" to the Washington State Department of Labor and Industries on the form they provide. The "Request for Release" form is for the purpose of obtaining a release with respect to the payments of L & I industrial insurance and medical aid premiums.

3.2.2 Applicable Law.

3.2.2.1 All written instruments, agreements, bid documents, specifications, and other writings of whatsoever nature which are a part of the work shall be construed, for all purposes, solely and exclusively in accordance with and pursuant to the law of the State of Washington. The rights and obligations of Bidders, the Purchaser, and the Contractor shall be governed by the laws of the State of Washington.

3.2.2.2 Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

3.3 PREVENTION OF ENVIRONMENTAL POLLUTION AND PRESERVATION OF PUBLIC NATURAL RESOURCES

3.3.1 Water Pollution Control Requirements: The Contractor shall conduct the work in accordance with all applicable pollution control laws. The Contractor shall comply with and be liable for all penalties, damages and violations under Chapter 90.48 RCW, in performance of the work.

3.3.2 Prevention of Pollution and Preservation of Natural Resources: The following list represents those Federal, State and local statutes, ordinances and regulations pertinent to the preservation of public natural resources currently known to the Owner that may affect or may be affected by the work. Bidders shall revise such materials and related regulations prior to submitting bids.

3.3.2.1 Federal: National Environmental Policy Act of 1969, 42 USC 4321 et. seq; Executive Order 11514; Clean Water Act, 33 USC 1251 et seq.

3.3.2.2 State: Water Pollution Control Act, Chapter 90.48 RCW; State Environmental Policy Act of 1971, Chapter 43.21C RCW and WAC Chapter 197-11; Noise Control Act of 1974, Chapter 70.107 RCW; Washington Clean Air Act, Chapter 70.94 RCW and WAC Chapter 1; Shoreline Management Act of 1971; Chapter 90.58 RCW.

3.3.2.3 Regional: Regulations I and II – Puget Sound Air Pollution Control Agency. The Contractor shall comply with applicable portions of the listed statutes, ordinances and regulations and such other regulatory measures dealing with the prevention of environmental pollution and the preservation of public natural resources as may be subsequently identified by the Owner or other public agencies as applicable to the work.

3.3.2.4 Local: Laws and regulations of Skagit County and the City of Mount Vernon.

3.7 PERMITS, FEES AND NOTICES

3.7.1 Delete Subparagraph 3.7.1 in section 00 7000 General Conditions and the following substituted therefore:

3.7.1 The Owner shall secure and pay for the building, floodplain development, fill and grade, right-of-way, mechanical, plumbing, monument sign permit. Owner will pay for

electrical and all other permit fees while Contractor shall secure these permits, if required. The Contractor shall secure and pay for all other permits and governmental fees, licenses, and inspections necessary for proper execution of and completion of the Contract which are legally required when bids are received or negotiations concluded. The Contractor shall also secure and pay for any locally required bonds, guaranteeing proper execution and completion of Work. Said fees shall be understood to be included in the Contractor's bid price. The Contractor shall pay consumer, use, and other taxes required by law including all taxes properly assessed against his equipment or property used in connection with the Work. The Contractor shall submit, coordinate and secure all utility service connections. Connection fees, general facilities charges and similar large utility charges (greater than \$500.00) will be paid to the utility out of Owner's funds.

ARTICLE 5 – SUBCONTRACTORS

5.1 PREVENTION OF ENVIRONMENTAL POLLUTION AND PRESERVATION OF PUBLIC NATURAL RESOURCES

5.1.1. Water Pollution Control Requirements: The Contractor shall conduct the work in accordance with all applicable pollution control laws. The Contractor shall comply with and be liable for all penalties, damages and violations under Chapter 90.48 RCW, in performance of the work.

5.1.2. Prevention of Pollution and Preservation of Natural Resources: The following list represents those Federal, State and local statutes, ordinances and regulations pertinent to the preservation of public natural resources currently known to the Owner that may affect or may be affected by the work. Bidders shall revise such materials and related regulations prior to submitting bids.

5.1.2.1. Federal: National Environmental Policy Act of 1969, 42 USC 4321 et. seq; Executive Order 11514; Clean Water Act, 33 USC 1251 et seq.

5.1.2.2. State: Water Pollution Control Act, Chapter 90.48 RCW; State Environmental Policy Act of 1971, Chapter 43.21C RCW and WAC Chapter 197-11; Noise Control Act of 1974, Chapter 70.107 RCW; Washington Clean Air Act, Chapter 70.94 RCW and WAC Chapter 1; Shoreline Management Act of 1971; Chapter 90.58 RCW.

5.1.2.3. Regional: Regulations I and II – Puget Sound Air Pollution Control Agency. The Contractor shall comply with applicable portions of the listed statutes, ordinances and regulations and such other regulatory measures dealing with the prevention of environmental pollution and the preservation of public natural resources as may be subsequently identified by the Owner or other public agencies as applicable to the work.

5.1.2.4. Local: Laws and regulations of Skagit County and the City of Mount Vernon.

ARTICLE 11 – INSURANCE & BONDS

11.1 BONDS

- 11.1.1 The Contractor shall furnish performance and payment Bonds for the faithful performance and payment of all his obligations under the Contract Documents. Each bond shall be in penal sums at least equal to the contract price unless otherwise stated, in such form, and with such sureties as are acceptable to the Owner. Sureties, to be accepted to the Owner, shall be legally authorized to do business in the State and jurisdiction where the Work is to be constructed. The Performance Bond shall remain in effect to guarantee the repair and replacement of defective equipment, materials, and workmanship, and payment of damages sustained by the Owner on account of such defects, discovered within one (1) year after final acceptance by the Owner.
- 11.1.2 Attorneys-in-fact, who sign Bid Bonds or Contract Bonds, must file with each Bond a certified and effectively dated copy of the Power of Attorney.
- 11.1.3 The surety company shall familiarize itself with all of the conditions and provisions of this Contract, and it waives the right of special notification of any change or modification of this Contract or of extension of time, or of decreased or increased work, or of the cancellation of the Contract, or of any other act or acts by the Owner or its authorized agents under the terms of this Contract; and failure to so notify the aforesaid surety companies of changes shall in no way relieve the surety companies of their obligations under this Contract.

11.2 INSURANCE

- 11.2.1 The contractor shall obtain and keep in force during the term of the contract, Commercial General Liability insurance policies with insurance companies which have an A.M. Best's rating of A: VII or better and who are approved by the Insurance Commissioner of the State of Washington pursuant to Title 48 RCW.
- 11.2.2 Prior to the execution of the contract, the contractor shall purchase and maintain during the term of this project a Commercial General Liability insurance policy meeting the requirements set forth herein. The contractor shall file with the Owner either a certified copy of all policies with endorsements attached, or a certificate of insurance with endorsements attached as are necessary to comply with these specifications. Failure of the contractor to fully comply with the requirements regarding insurance will be considered a material breach of contract and shall be cause for immediate termination of the contract and of any and all Owner obligations, regarding same.
- 11.2.3 The contractor shall not begin work under the contract or under any special condition until all required insurances have been obtained and until such insurances have been approved by the Owner. The insurance shall provide coverage for the contractor, the contractor's subcontractors and the Owner. The coverage so provided shall protect against claims from bodily injuries, including accidental death, as well as claims for property damage which may arise from any act or omission of the contractor, the contractor's subcontractors, or by anyone directly or indirectly employed by either of them.
- 11.2.4 The insurance policies shall specifically name the Owner, its elected and appointed officials, officers, employees, agents and volunteers as insureds with regards to damages and defense of claims arising from: (a) activities

performed by or on behalf of the contractor; (b) products and completed operations of the contractor, and (c) premises owned, leased or used by the contractor. The insurance shall be maintained in full force and effect at the contractor's expense throughout the term of the contract.

- 11.2.5** The Contractor's insurer shall endeavor to give the Owner at least 30 days written notice of cancellation, nonrenewal, material reduction or modification of coverage. Such notice shall be by *certified mail* to the Owner.
- 11.2.6** The coverages provided by the contractor's insurance policies shall be primary to any insurance maintained by the Owner, except as respects losses attributable to the sole negligence of the Owner. Any insurance that might cover this contract which are maintained by the Owner shall be in excess of the contractor's insurance and shall not contribute with the contractor's insurances.
- 11.2.7** The contractor's insurance policies shall protect each insured in the same manner as though a separate policy had been issued to each. The inclusion of more than one insured shall not affect the rights of any insured as respects any claim, suit or judgment made or brought by or for any other insured or by or for any employee of any other insured. However this provision shall not increase the limits of the insurer's liability.
- 11.2.8** The General Aggregate provision of the contractor's insurance policies shall be amended to show that the General Aggregate Limit of the policies applies separately to this project.
- 11.2.9** The contractor's insurance policies shall not contain deductibles or self-insured retentions in excess of \$10,000 unless approved by the Owner.
- 11.2.10** The contractor's insurance policies shall contain a provision that the Owner has no obligation to report events which might give rise to a claim until a claim has been filed with the Owner's Board of Commissioners.
- 11.2.11** Types and Limits of Insurance Required:
- Commercial General Liability**
- \$2,000,000 each occurrence Bodily Injury and Property Damage liability
 - \$2,000,000 annual aggregate
 - Employees and volunteers as Additional Insureds
 - Premises and operations
 - Broad form property damage including underground, explosion and collapse hazards (XCU)
 - Products completed operations
 - Blanket contractual
 - Subcontractors
 - Personal injury with employee exclusion deleted
 - Employers liability (Stop gap)
- Automobile Liability**
- \$2,000,000 per accident bodily injury and property damage liability, including
 - Any owned automobile
 - Hired automobiles
 - Non-owned automobile
- Umbrella Liability**
- \$2,000,000 per occurrence

- \$2,000,000 aggregate

11.2.12 Builder's Risk Insurance:

11.2.12.1 "All Risk" Builder's Risk Insurance in an amount equal to the contract price, shall cover, but not be limited to, fire, lightning, windstorm, hail, explosion, riot, riot attending a strike, civil commotion, smoke damage, damage by aircraft or vehicles, vandalism and malicious mischief, theft, collapse, flood and earthquake. This insurance shall name the Owner and the Contractor as insureds and shall include coverage, by way of example but not by way of limitation, for all damages or loss to the work and to appurtenances, to materials and equipment to be used on the project site, to construction plant and temporary structures, and for any damage or loss to any existing plant facilities.

11.2.12.2 Such insurance may have a deductible clause, but not to exceed the below listed amounts. (The deductible on earthquake may be in accordance with the underwriters' requirements.)

- (a) Flood: \$10,000
- (b) All other perils, except earthquakes: \$ 2,500

11.2.12.3 The policy shall provide the Owner the right to occupy the premises without termination of the policy until the final acceptance of the project.

11.2.13 As an alternative to the above indicated Commercial General Liability and Umbrella Liability insurance policies the contractor may provide the Owner with an Owners and Contractors Protective (OCP) policy with a limit of coverage of \$5,000,000. If the contractor provides an OCP policy, the contractor shall additionally provide the Owner with evidence that the contractor's Commercial General Liability policy has been endorsed adding the Owner, its elected and appointed officials, officers, employees, agents, project related consultants and volunteers as insureds for at least products completed operations coverage.

11.2.14 Providing of coverages in the stated amounts shall not be construed to relieve the contractor from liability in excess of such limits.

11.2.15 The contractor shall have its insurance agent/representative complete the Insurance Coverage Questionnaire contained in the proposal and attach it to the certificate of insurance for Owner's approval.

11.2.16 The contractor shall maintain Workers Compensation insurance and/or Longshore and Harbor Workers insurance (or Jones Act coverage for all employees eligible for same) as required by state or federal statute for all of the contractor's employees to be engaged in work on the project under this contract and, in case any such work is sublet, the contractor shall require the subcontractor similarly to provide workers compensation insurance and/or longshore and harbor workers insurance (or Jones Act coverage) for all of the subcontractor's employees to be engaged in such work. The contractor's Department of Labor & Industries account number shall be noted on the certificate of insurance. In the event any class of employees engaged in the work under this contract is not covered under Workers Compensation insurance or Longshore and Harbor Workers insurance (or Jones Act coverage) as required by state and federal statute, the contractor shall maintain and cause each subcontractor to maintain, Employers Liability insurance for limits of at least \$1,000,000 for each employee for disease or accident, and shall furnish the Owner with satisfactory evidence of such.

- 11.2.17** The contractual coverage of the contractor's policy shall be sufficiently broad enough to insure the provisions of the INDEMNIFICATION ADDENDUM of this contract.
- 11.2.18** Nothing contained in these insurance requirements shall be construed as limiting the extent of the contractor's responsibility for payment of damages resulting from the contractor's operations under this contract.

END OF SECTION 00 7700

PART II

Technical Specifications

SECTION 01 1000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special 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. Work by Owner.
- 4. Work under separate contracts.
- 5. Owner-furnished products.
- 6. Contractor-furnished, Owner-installed products.
- 7. Access to site.
- 8. Coordination with occupants.
- 9. Work restrictions.

- B. Related Section:

- 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Skagit PUD - PN 3675 Campus Replacement Administration Building

- 1. Project Location: 1415 Freeway Drive, Mount Vernon, WA 98273

- B. Owner: Skagit PUD

- 1. Owner's Representative(s): Sam Shipp

- C. Architect and Other Owner Consultants: The Owner has retained design professionals listed in the Drawings who have prepared designated portions of the Contract Documents.

- D. Construction Inspection, Testing and Specialized Consultants: The Owner has retained the following design professionals and companies for provision of independent construction-related services:

- 1. Construction Inspections and Testing Agency: To be selected by Owner if needed.

- E. Project FTP Web Site: A Project Web site administered by the Architect has been established and will be used for purposes of managing communication and documents during the construction stage.

1. Purpose: The web site will be used for convenient electronic document transfers, submittals processing and similar uses that facilitate communications between the Owner, Contractor (& subcontractors) and the Architect (& consultant team). The establishment use and continuance of the FTP web site is a convenience only, and is not to be construed as a requirement for the Owner or Architect under the Agreement.
2. Disclaimer: Due to the electronic nature of information, all drawings, specifications, sketches and other "contract documents" posted by the Owner, Architect and/or consultant team carry the following disclaimer:
 - a. **BY OPENING AND USING THESE FILES, YOU AGREE TO THE FOLLOWING:** The contents of these electronic files represent a proprietary design owned by DRIFTMIER ARCHITECTS, PS and are not to be used, in whole or in part, for any purpose or project other than the project noted above. The recipient shall not transmit the files to any other party without express written permission from the DRIFTMIER ARCHITECTS, PS. These are data files only, and are not a complete plan set or report. They are for information only, and are not to be used for construction. Dimensions should be verified before being used. If anyone uses these material for any purpose or project, modifies or converts the materials in any way, or retransmits them to another party, they assume all risks associated with such use, modification or conversion and shall release, indemnify and hold DRIFTMIER ARCHITECTS, PS harmless from all claims, liabilities, and costs, including but not limited to, all reasonable attorneys' fees and court costs, arising out of or in connection with any such use, modification, or conversion.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. **Type of Contract:** Project will be constructed under a single prime contract.
- B. **Documentation:** The Work of the Project is defined by the Contract Documents and consists of the following:
 1. The project is as shown on the contract documents prepared by Driftmier Architects and titled the same as this project manual.
- C. **Description of the Work:**
 1. The Project consists of the construction of a new, two-story office building on an existing sports field.
 2. Building work includes but not limited to construction of a new, two-story office building with public meeting space, an outdoor plaza and patio, and office spaces.
 3. Site-work includes but not limited to cut and fill, aggregate piers, parking lots, fencing and gates, lighting and landscaping.

1.5 ACCESS TO SITE

- A. General: The security of the building and the safety of people are of the highest priority. Contractor is to coordinate work hours with the Owner and Architect.

- B. Use of Site: Contractor will have access to the site, but may not impact the area of work until after August 1, 2023. GC may use parking as coordinated with the Owner. GC may utilize exiting play fields after August 1, 2023. All other areas must be coordinated with the Owner and Architect.
 - 1. Minimize disturbance in vegetated areas and those where natural vegetation is indicated to remain. Repair and re-vegetate areas disturbed by constructions activities.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Work is to be performed during normal business hours. Normal business hours are 7:00am-5:00pm Monday -Friday.
 - 1. Contractor is to coordinate with Owner to request hours outside of these times.
- 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 the Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain 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 or adjacent properties with Owner.
 - 1. Notify Owner not less than one day 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 of entrances, operable windows, or outdoor air intakes.
- F. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.
- G. Employee Screening: Comply with laws, regulations and Owner's requirements regarding citizenship and immigration status of workers. If requested, provide documentation for legal status, drug screening and background checks of Contractor personnel working on the Project site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 01 1200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

- A This Section specifies administrative and procedural requirements for project meetings including but not limited to:
1. Pre-Construction Conference.
 2. Pre-Installation Conference.
 3. Progress Meetings.

1.2 PRE-CONSTRUCTION CONFERENCE

- A Schedule a pre-construction conference and organizational meeting at the Project site or other convenient site prior to commencement of construction.
- B Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented.
- C Agenda: Discuss items of significance that could affect progress including such topics as:
1. Status of Contracts.
 2. Status of permit and AHJ requirements.
 3. Designation of responsible personnel.
 4. Construction schedule and critical work sequencing.
 5. Phasing and Construction Work Plan
 6. Procedures for processing field decisions and Change Orders.
 7. Procedures for processing Applications for Payment.
 8. Distribution of Contract Documents.
 9. Submittal of Shop Drawings, Product Data and Samples.
 10. Close out procedures.
 11. Use of the premises and Housekeeping.
 12. Office, Work and storage areas.
 13. Equipment deliveries and priorities.
 14. Safety procedures & First aid.
 15. Security.
 16. Working hours.

1.3 PRE-INSTALLATION CONFERENCES

- A Conduct a pre-installation conference at the site as indicated (or when requested by Architect or Owner) before each construction activity that requires detailed coordination among different trades or subcontractors. The Installer and representatives of manufacturers and fabricators involved, subcontractors, contractor, Architect, related subconsultants and Owner shall attend the meeting. Notify all parties of scheduled meeting dates.

1.4 PROGRESS MEETINGS

- A Conduct regularly scheduled progress meetings at the site for attendance by owner, architect, contractor, and superintendent. Included subconsultants, subcontractors, etc. as needed. Review schedule & work progress, review pay application inspection, and discuss constructions issues that arise. The contractor shall take notes and distribute meeting minutes for review within 5 days of meeting and incorporate all comments by the next meeting.
- B Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
 - 1. Contractor's construction schedule & coordination.
 - 2. Submittals & shop drawings.
 - 3. Requests for information (RFI).
 - 4. Permit issues.
 - 5. Pay application review.
 - 6. Work progress observations
 - 7. Change Order Proposals.
 - 8. Change Orders, Change Directives and Supplemental Instructions.
- C Reporting: The Architect shall keep minutes of the progress meetings, and no later than 7 days after each progress meeting distribute copies to each party present and to other parties who should have been present.
 - 1. Updating and Corrections: The Contractor shall promptly notify the Architect of any correction, additions or revisions that are needed to be made to the meeting minutes. Discuss differences that may arise at the next meeting.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01 1200

SECTION 01 2200 - UNIT PRICES

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 unit prices.

1.3 DEFINITIONS

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

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1 – Soil Over-Excavation and Disposal of Unsuitable Soil:

1. Description:

Cost for excavation and removing and legally disposing of off site all unsuitable soil material, which is determined unsuitable by the Owner's Representative, including labor, equipment, excavation, removal and disposal, street cleaning, traffic control (including flaggers) plus any other incidental work required. Measurement for payment will be based on the actual yardage volume of designated excavation area, as determined by cubic yards of material removed, as measured, calculated, and determined by the Owner.

- a. Unit Price: Note that the Base Bid is to include all removal of existing fill soil, necessary excavation, fill and grading as indicated on the drawings and provided in the specifications, in quantities as necessary to meet requirements of the contract documents for all work other than over-excavation below the indicated elevations. This unit price is to be used only for over-excavation and disposal of unsuitable soil.
- b. Unit of Measure: In-Place Cubic Yard.
- c. Assumed Quantities: There is no assumed quantity for the amount of over-excavation.

B. Unit Price No. 2 – Imported Structural Fill:

1. Description:

Cost for providing and compacting in place, imported structural fill material in place of removed unsuitable soil (Unit Price No. 1), complete in place and ready to use, all as specified therefore under applicable Sections of Division 32. The contract unit price shall include all labor, materials, equipment, hauling, placing, compacting, and other incidental work specified and shown on the drawings. Measurement for payment will be based on the material required to displace the over-excavation, as determined by tons of material placed and compacted, and verified by actual truck tickets.

- a. Unit Price: Note that the Base Bid is to include all necessary excavation, fill and grading as indicated on the drawings, and removal or existing fill soil and replacement with imported structural fill as specified and in quantities as necessary to meet requirements of the contract documents for all work. This unit price is to be used only for imported structural fill in place of removed unsuitable soil.
- b. Unit of Measure: Ton (compacted in place).
- c. Assumed Quantities: There is no assumed quantity for the amount of over-excavation.

END OF SECTION 01 2200

SECTION 01 2300 –ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes a description of Base Bid work, a description of Alternates, along with the administrative and procedural requirements governing Alternates.

1.2 DEFINITIONS

- A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES FOR ALTERNATES

- A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
 - 2. Each alternate includes costs of all related coordination, modifications or adjustments to work surrounding the area affected which are made necessary by the alternate.
- B. Cost Procedures: Incorporate in the cost of the alternate all work necessary to provide and fully install the specified components and systems. Also, include in the cost all savings due to Base Bid elements that are made unnecessary by the alternate. The cost of the alternate shall be the net change in contract price after incorporating all cost additions and reductions due to the installation of the alternate as described.
- C. Notification: Following the award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- D. Execute accepted alternates under the same conditions as other Work of this Contract. Alternates will likely be accepted by the owner for inclusion in the contract work. The owner retains the right to accept additional alternates (by change order) within 30 days of award.
- E. Schedules: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

<u>Number</u>	<u>Description of Alternate:</u>
Alternate No. 1	<u>Remove Small Classroom 111:</u> Base bid includes classroom and associated mechanical and electrical items. This work removes all architectural, structural, mechanical and electrical elements associated with the room. The door to the closet is relocated to the south wall where it is accessed from the lobby. The exterior wall assemblies of adjacent walls is be extended to replace what are interior walls in the base bid. The exterior area will be landscaped to match the adjacent landscaping.
Alternate No. 2	<u>Remove Track 201 and Stair 2:</u> Base bid included running track and stair 2. This work removes track floor structure, supports, railing, the entirety of stair 2 and section of concrete sidewalk leading to stair. The opening from Exercise 202 to the track is infilled with metal framed wall and aluminum storefront. The storage rooms on level 1 remain with a sloped ceiling added to replace the floor structure of the track. The remaining gym structure will be sufficient to support the track if added in the future.
Alternate No. 3	<u>Remove exterior enclosure for stair 2:</u> Base bid include the exterior enclosure and associated structure and lighting. This work removes the enclosure, structure, lighting, level 1 door, roof ladder and floor slab. The adjacent exterior wall assembly will extend to replace the interior wall between the stair and gym. The interior design build stair will be replaced with a design build painted steel stair, guardrails, handrails and metal grate treads.
Alternate No. 4	<u>Remove upper roof mechanical screen:</u> Base bid includes preformed metal panel mechanical screen, associated structure and roof flashing on the upper roof. This work removes the mechanical screen and structure. The mechanical screen on lower roof on the south side will remain.
Alternate No. 5	<u>Remove steel canopies:</u> Base bid includes painted steel canopies on north and south elevations. This work removes the canopies and lighting.
Alternate No. 6	<u>Remove skylights:</u> Base bid includes 13 skylights. This work removes 13 skylights, curbs and drainage crickets. Extend adjacent roof assembly to replace skylights.
~~Alternate No. 7~~	~~<u>Remove Concrete roof deck:</u> Base bid includes concrete fill over metal deck on level 2 north of grid 4 and south of grid 6 for future expansion. This work removes the concrete fill and replaces the roof assembly R3 with roof assembly R2. (Add #5)~~
Alternate No. 8	<u>Remove wood plinth below Stair 1:</u> Base bid includes a 1'-2" high wood clad plinth below stair 2. This work removes the plinth and replaces it with a 1 ½" stainless steel pipe cane rail mounted at 27" above the floor directly below the outside stair stringer to

	a point where the bottom of the stringer is greater than 80” above floor level. The cane rail will then return to the north wall of the lobby. The bottom two treads will be concrete filled metal pan to match the typical treads.
Alternate No. 9	<u>Reduce upper cabinet height size:</u> Base bid includes 3’-0” tall upper cabinets. This work reduces the height of the upper cabinets to 2’-6”. Extend wall paint and finish to top of 2’-6” cabinet.
Alternate No. 10	<u>Gym bleachers:</u> Base Bid includes automatic telescoping bleachers. This work removes the bleachers and replaces them with 4 row 20’ wide tip and roll aluminum bleachers. Maintain power outlets for future installation of automatic bleachers.
Alternate No. 11	<u>Locker room sinks:</u> Base bid includes laminate counter tops and drop in sinks in Men’s Locker 128, Women’s Locker 124, Family Room 125 and Family Room 127. This work removes counter tops and 8 sinks and replaces them with the wall hung sink used in the other restrooms.
Alternate No. 12	<u>Remove acoustic light fixtures:</u> Base bid includes 3 acoustic pendent light fixtures in Lobby 102. This work removes the 3 fixtures with no replacement.
Alternate No. 13	<u>Replace tile in locker rooms:</u> Base bid includes ceramic tile in Men’s Locker 128, Women’s Locker 124, Family Room 125 and Family Room 127. This work replaces the tile with Armstrong Colorart Accolade Plus Sheet Vinyl.
Alternate No. 14	<u>Remove interior fiber cement panels:</u> Base bid includes fiber cement panels FC-1 behind the reception desk. This work replaces the FC-1 panels with 1 extra layer of GWB, painted PT-10.
Alternate No. 15	<u>Trash Enclosure:</u> Base bid includes CMU trash enclosure with cap. This work replaces the CMU with 6’ tall vinyl coated chain link fence and swinging gate with privacy slats.
Alternate No 16	<u>Fire Pump:</u> Base bid does not include a fire pump. This work adds a fire pump and associated plumbing and electrical work if it is determined that a pump will be required due to low water pressure.

END OF SECTION 01 2300

SECTION 01 2900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies 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. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - 1. Application for Payment forms with continuation sheets.
 - 2. Submittal schedule.
 - 3. Items required to be indicated as separate activities in Contractor's construction schedule.
- B. Submit the schedule of values to Architect at earliest possible date but no later than 15 days before the date scheduled for submittal of initial Applications for Payment.
- C. Format and Content: Use the 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. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
 - 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, 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 and Supplier.
 - e. Dollar values for labor, materials and equipment, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Include a separate line item for Project Closeout related administrative work. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. 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.
6. Project Closeout Phase and Punch List Work: Include separate line item(s) for closeout requirements.
 - a. These amounts are not retainage, but are for the purpose of covering the cost for record submittals, record drawings, operations & maintenance manuals and other closeout activities that are required by the Contract Documents.
7. 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. At the Contractor's option, 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. Line items so separated shall be paid as a percentage of project completion.
8. Schedule Updating: Update 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. Each Change Order shall be considered a new line item on the Schedule of Values for Payment Applications, with separate sub-items related to specific changes as appropriate.

1.5 APPLICATIONS FOR PAYMENT

- A. Each 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. Application for Payment Forms: Use AIA Document G702 and AIA Document G703, continuation sheets as the form for Applications for Payment. Modify the form or provide attached calculation for Washington State Sales tax per the General Conditions.
- D. Any Application for Payment submitted that is not mathematically correct or which is not typewritten will be rejected as unacceptable.
- 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. Percentages for Progress Payments: Prior to the application that corresponds with full substantial completion of the project, the Architect is under no obligation to certify more than 95% on any line item on the application. The Architect is not able to make the certification in the General Conditions since a comprehensive inspect of the work has not been conducted in association with the application.
 4. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- 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. Materials previously stored and included in previous Applications for Payment.
 - b. Work completed for this Application utilizing previously stored materials.
 - c. Additional materials stored with this Application.
 - d. Total materials remaining stored, including materials with this Application.
- 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.

- 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 waivers of lien on forms, executed in a manner acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the 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. Submittal schedule (preliminary if not final).
 5. Certificates of insurance and insurance policies.
 6. Performance and payment bonds (if required).
 7. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. This application shall be for 100% of all completed work less amounts reserved for completion of punchlist items, a separate item for Closeout Administration and less retainage.
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 Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Administrative actions and submittals that shall proceed or coincide with the Application at Substantial Completion include:
1. Occupancy permits and similar approvals.
 2. Warranties (guarantees) and maintenance agreements. Maintenance instructions.
 3. Meter readings.
 4. Change-over information related to Owner's occupancy, use, operation and maintenance.
 5. Final cleaning. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
 6. Complete updated list of all subcontractors and major suppliers who have provided labor, materials and equipment as a part of this Contract.
- L. Application for Payment at Physical Completion: Following issuance of a determination of Physical Completion, submit an Application for Payment; this application shall reflect all Certificates of Substantial Completion issued previously for the work. This application shall be

for 100% of all completed work less the line item for Closeout Administration and less retainage. This application shall not be submitted until all work is physically complete.

M. Administrative actions and submittals that shall proceed or coincide with the Application at Physical Completion include:

1. Final progress photographs.
2. List of any incomplete Work or items still necessary to conclude Contractor's obligations to the Owner under this Contract.

N. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Completion of Project Closeout requirements.
2. Physical Completion where all of the Work associated with the contract is physically complete as recognized by the Owner's Representative / Architect's Certificate of Physical Completion.
3. Assurance that unsettled claims will be settled. Submit Waiver of Mechanics Lien for all Contractors, subcontractors or major suppliers responsible for all labor, materials and equipment as a part of the Work in this contract.
4. Transmittal of required Project construction records to Owner.
5. Proof that taxes, fees and similar obligations have been paid. Submit Affidavits of Wages Paid for each contractor and subcontractor.
6. Application for reduction of retainage, and consent of surety.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish and similar elements.
9. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General 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 project coordination procedures.
 - 2. Administrative and supervisory personnel.
 - 3. Coordination drawings.
 - 4. Requests for Information (RFIs).
 - 5. Project Web site.

1.3 DEFINITIONS

- A. RFI: Request for Information from Owner, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

- 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.
 - 4. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
- B. Drawings and Subcontractor Scope: The drawings are complementary and do not define subcontractor work scopes. What is called for in one place shall be provided as if called for in all.

1. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
 2. Provide all electrical mechanical and other incidental items needed by bidder designs or shop drawings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Installation and removal of temporary facilities and controls.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Preinstallation conferences.
 6. Project closeout activities.
- D. 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.
- E. Delivery lead times on some items may be slow. The general contractor and all subcontractors shall prepare submittals, order materials, equipment, etc., sufficiently in advance to assure timely construction or installation of long lead time items.
- F. Each subcontractor is considered a specialist in his respective field/trade and shall (prior to performance of work) notify the general contractor and the architect of any work called out in the drawings or specifications which cannot be fully warranted or constructed as designed or detailed.
- G. Provide all coordination with inspections from authorities having jurisdiction. Meet inspector requirements, secure sign offs and authorizations to occupy. Coordinate with architect and owner as needed.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, 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 information necessary to show all related work and work which has a potential impact on the subject systems and materials.
- B. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient

scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.

1. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."
- C. Coordination Digital Data Files: At contractor's option, prepare coordination digital data files in accordance with the following requirements:
 1. Drawing File Preparation Format: Same digital data software program, version, and operating system as the original Drawings - AutoCAD Release 2007, Revit Architecture, or Portable Data File (PDF) format.
 2. Other File Preparation Formats: Microsoft Office applications operating in Microsoft Windows XP operating system, including: Word, Excel, Project or PowerPoint.
 3. Architect will furnish Contractor one set of digital data files of the Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of an Agreement form acceptable to the Owner and Architect.

1.6 KEY PERSONNEL

- A. Key Personnel Names: Within 5 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 email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.
 2. Designate personnel contact information for on-call, after hours and emergency response purposes.

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. Clearly and specifically state the question and indicate the date & manner of response needed. Indicate if potential contract time or cost modification are involved. Include the following:
1. Project name, project number and date.
 2. RFI number, numbered sequentially.
 3. RFI subject.
 4. Specification Section number and title and related paragraphs, as appropriate.
 5. Drawing number and detail references, as appropriate.
 6. A check box and explanation of potential impacts to contract cost or time.
 7. Field dimensions and conditions, as appropriate.
 8. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 9. Name of contractor personnel submitting the RFI.
 10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 or Contractor's form with the same content as indicated above, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required in consultation with the Owner as needed, and respond. Allow seven (7) 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 RFIs may be returned without action. Submit in accordance with requirements of the other applicable sections of the Contract Documents. They include:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information or clarification, in which case Architect's time for response will date from time of receipt of additional information.
 3. RFI responses do not authorize a change to the contract sum or time. 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 Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect immediately in writing, and in any case within seven (7) days of receipt of the RFI response.
 - b. Prepare a change order proposal and receive authorization prior to proceeding with the work of the RFI. The Owner is not obligated to approve or pay for changes

resulting from work installed as directed in an RFI response that was not disclosed by the Contractor as a potential change order issue.

- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.
- F. RFI Log: Contractor shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at each progress meeting. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect[and Construction Manager].
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT WEB SITE

- A. The Architect's web (FTP) site (or other site as approved by the Owner) may be available for purposes of facilitating and managing project coordination communication and documentation until Final Completion.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences as indicated in Division 01 Section "Project Meetings,"

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Division 01 Section "Project Closeout" for submitting operation and maintenance manuals, submitting record drawings, record specifications, record product data and related submittals.

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.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- 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.
- 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 modifications to submittals noted by the 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. Submit concurrently with start-up 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. 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. Requested date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled dates for installation.
 - i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals except by special arrangement.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 2. 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 and end when the submittal is transmitted or ready for pick up at the Architect's office. 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 14 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 14 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. Architect will indicate sequential submittals during review of the submittal schedule.
- D. Options: Identify options requiring selection by the Architect.
- E. Deviations and Comparable Manufacturers, Products and Systems: Identify on submittals all deviations from the Contract Documents, including any comparable products, substitutions or variations from products or systems named in the specifications. Failure to identify deviations can result in rejection of the submittal or work by the Architect at whatever point in the review process the deviation is noticed; even if noticed after the review is returned.
- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of revision in label or title block and clearly indicate extent of revision.
 2. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- G. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- H. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- I. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- J. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

PART 2 - PRODUCTS

2.1 GENERAL SUBMITTAL PROCEDURES

- A. General Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- B. Quantity of Submittal Documents: Submit in form and quantity described in the following sections.

1. Action Submittals: Submit three paper copies of each submittal plus the quantity the Contractor wants to have returned, unless otherwise indicated. Architect will return up to two annotated copies. Thus, five (5) copies are normative.
 2. Informational Submittals: Submit two paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
 3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- C. Transmittal and Action: Assemble each submittal individually and appropriately for transmittal and handling. Architect will return submittals, without review, received from sources other than Contractor.
1. Concurrent Consultant Transmittal for Review: Upon prior arrangement with Architect, submittals may be transmitted simultaneously to Architect and to Architect's consultants for sequential review. Submittals will be returned to Architect before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect
 - b. All concurrent submittals must have the Architect's action stamp or transmittal to be valid. No direct return of submittals by consultants is permitted or valid.
 2. Transmittal Form: Provide Contractor's standard transmittal form attached to all submittals.
 3. On an attached separate sheet record relevant information, requests for data, revisions on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- D. Method of Submittal Transfer: Paper submittals shall be the normative form for submittal submission and review with Architect. Some types of submittal data may be transmitted electronically by email or by posting on Architect's FTP site, if available.
1. Transmittal in Paper Form: Transmittal may be accomplished by US mail, express mail, and courier or in person. Place a permanent label or title block on each paper copy submittal item for identification. Indicate name of firm or entity that prepared each submittal on label or title block.
 - a. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 2. FTP Site Posting: Post electronic submittals as electronic PDF files, or other acceptable format, directly to Architect's FTP site specifically established for Project.
 - a. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
 - 1) Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
 - 2) Name file with submittal number or other unique identifier, including revision identifier.
 - 3) Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - b. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

3. Submit electronic submittals via email as PDF electronic files.
 - a. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
 - 1) Name file with submittal number or other unique identifier, including revision identifier.
 - b. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2.2 PRODUCT DATA

- A. Collect information into a single submittal for each element of construction and type of product or equipment. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
 1. Mark each copy of each submittal to show which products and options are applicable.
 2. 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.
 3. 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.
 4. Preliminary Submittal: Submit two preliminary copies of Product Data where selection of options is required. Otherwise, submit Product Data before or concurrent with Samples
 5. Submit Product Data in either paper or electronic format.

2.3 SHOP DRAWINGS

- A. 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. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings.

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.
 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 but no larger than 24 by 36 inches.
 3. Submit Shop Drawings in the following format and quantity:
 - a. Drawing Size up to 11" x 17": Paper or PDF electronic file format.
 - b. Drawing Size greater than 11" x 17": Paper submission is required, with or without PDF electronic file format.
 - c. Three opaque paper copies of each submittal plus the quantity to be returned to the Contractor. Architect will return up to two annotated copies.
- B. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
1. Coordination Drawings may include components previously shown in detail on Shop Drawings or Product Data.

2.4 SAMPLES

- A. 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.
 3. 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.
- 4. 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 minimum two full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one set of the submittal with options selected.
- 5. 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 minimum of three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit units that show approximate limits of variations.

2.5 SUBCONTRACTOR LISTING

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, 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.
 - 4. Submit subcontract list in either paper or electronic format:

2.6 LEED SUBMITTALS

- A. LEED and Sustainability Submittals: Comply with requirements specified in Division 01 Section "Sustainable Design Requirements" as applies to the project.
 - 1. Submit in the following format:

- a. PDF electronic file or three paper copies of sustainable design submittals, unless otherwise indicated.

2.7 MISCELLANEOUS SUBMITTALS

- A. 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.
- B. 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 American Welding Society (AWS) forms. Include names of firms and personnel certified.
- C. 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.
- D. 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.
- E. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- F. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- G. 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.
- H. Product Test Reports: Submit written reports indicating 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.
- I. 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.

- J. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- K. 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.
- L. 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.
- M. Field Test Reports: Submit 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.
- N. Maintenance Data: Comply with requirements specified in Division 01 Section "Project Closeout Procedures."
- O. 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.

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.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will either stamp each submittal with an action stamp and will mark stamp appropriately to indicate action or attach Architect's standard review transmittal to indicate action. These will be appropriately marked, as follows, to indicate the action taken:
 - 1. Final Unrestricted Release: Where submittals are marked "No Exception Taken," that part of the Work covered by the submittal may proceed, provided it complies with requirements of the Contract Documents.

2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted," that part of the Work covered by the submittal may proceed, provided it complies with notations or corrections on the submittal and requirements of the Contract Documents.
 3. Returned for Re-submittal: When a submittal is marked "Correct and Resubmit," do not proceed with that part of the Work covered by the submittal, or the portion of the work for which additional review is required. Where only some elements of the submittal are indicated for correction and re-review, then Work related to other parts or the submittal may proceed provided it complies with requirements of the Contract Documents. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 4. Not Approved Submittals: When a submittal is marked "Rejected", do not proceed with that portion of the Work covered by the submittal, including purchasing, fabrication, delivery or other activity. Prepare a new submittal with the products and materials called for in the Contract Documents and submit without delay.
 5. Do not permit submittals "Revise and Resubmit" or "Rejected" to be used at the Project site, or elsewhere where Work is in progress.
 6. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General 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. Testing and inspecting services are required to verify compliance with requirements specified or indicated.
 - 1. Specific quality-assurance, inspection and testing 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 procedures that facilitate compliance with the Contract Documents. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 3. Requirements for quality-control services and testing services required by Architect, Owner, or authorities having jurisdiction are covered by provisions of this Section. Services do not include contract enforcement activities performed by Architect

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed by Contractor 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.
- C. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- D. 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.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 INFORMATIONAL SUBMITTALS

- A. Testing Agency Qualifications: For Contractor's testing agencies, if different from Owner's, 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.
- B. Schedule of Tests and Inspections as described under "Contractor Responsibilities".

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports - General: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue, project title and number.
 - 2. Name, address, and telephone number of testing agency.
 - 3. Dates and locations of samples and tests or inspections.
 - 4. Names of individuals making tests and inspections.
 - 5. Description of the Work and test and inspection method.
 - 6. Identification of product and Specification Section.
 - 7. Complete test or inspection data.
 - 8. Test and inspection results and an interpretation of test results.
 - 9. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 10. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 11. Name and signature of laboratory inspector.
 - 12. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections.
- C. 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.
- D. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor and Owner. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 1. Submit additional copies of each written report directly to authorities having jurisdiction for code and jurisdiction-required tests and inspection, or when they so direct.
 - 2. At substantial completion of the project, submit summary certification letter to authorities having jurisdiction as necessary to meet their requirements. Certify that all required tests

and inspections were made and were in compliance with codes and the Contract Documents. Remit copies to the Owner, Architect and Contractor.

1.6 CONTRACTOR QUALITY ASSURANCE PROCEDURES

- A. 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.
- B. 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.
- C. 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.
- D. Professional Engineer Qualifications: Where indicated for Contractor-provided delegated design: 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 to those indicated for this Project in material, design, and extent.
- E. 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.
- F. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance, Contractor responsibilities include the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

1.7 QUALITY CONTROL, TESTING AND INSPECTION SERVICES – GENERAL

- A. Testing Agency Responsibilities: Cooperate with Owner, 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.

B. Manufacturer's Technical and Field Services: Where indicated, the Contractor shall engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Manufacturer's technical services may include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, and observation of Installer activities. Report results in writing as specified in Division 01 Section "Submittal Procedures."

1.8 QUALITY CONTROL, TESTING AND INSPECTION SERVICES – OWNER RESPONSIBILITIES:

- A. The Owner will provide inspections, tests and similar quality control services where specified to be performed by independent testing agencies, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
1. The Owner will employ and pay for the services of one or more independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility. Soils and geotechnical inspections shall be conducted either by Owner's soils consulting engineer or by another independent agency
 2. The Owner's independent agency, testing laboratory or other qualified firm will conduct all normal special inspections required by code and the Building Department, unless noted to be provided by Contractor.
 3. 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.

1.9 QUALITY CONTROL, TESTING AND INSPECTION SERVICES – CONTRACTOR RESPONSIBILITIES:

- A. Tests and inspections not assigned to Owner are Contractor's responsibility. Where services are stated as Contractor's responsibility in the Contract Documents, engage a qualified testing agency to perform these quality-control services.
1. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor may employ the entity engaged by the Owner or another entity.
 2. The Contractor's independent agency shall perform quality control services where such are needed by subcontractors, material suppliers, etc. to show compliance with manufacturer's or installer's requirements and contract conditions. This includes, for example, concrete slab cure tests needed to show compliance with floor covering manufacturer's warranty requirements.

3. The Contractor's independent agency (at Contractor expense) shall perform quality-control activities required to verify to the Contractor that the Work complies with requirements, whether specified or not. Perform quality control services at the Owner or Architect's direction where such are needed to demonstrate conformance with requirements of the Contract Documents. This includes, for example, moisture testing of framing products exposed to the weather to confirm sufficient dry-out prior to covering.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- B. The Contractor shall coordinate all testing and inspection activities of the work by all agencies. This includes tests and inspections conducted by the Owner's and Contractor's agencies to meet the requirements of the Contract Documents, the Building Department or other jurisdictional agencies.
- C. Retesting and Re-inspection: Regardless of whether original tests or inspections were Contractor's responsibility, the Contractor is responsible to pay for any and all retesting where results of required inspections, tests or similar services prove unsatisfactory and indicate non-compliance with Contract Document requirements. Rectify non-compliant conditions and continue to retest until satisfactory results are achieved.
1. 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, and the Contract Sum may be adjusted by Change Order
- D. Notify testing agencies at least 24 hours (exclusive of weekends and holidays) in advance of time when Work that requires testing or inspecting will be performed.
- E. 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 access to the Work, incidental labor and facilities necessary to facilitate tests and inspections, facilities for storage and field curing of test samples, delivery of samples to testing agencies and similar services.
- F. Coordination: Coordinate sequence of activities to accommodate testing agency personnel and services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Coordinate the work to allow testing for testing upon the greatest amount of work per trip practical. Group scheduled times for tests, inspections, obtaining samples, and similar activities to minimize the number of trips necessary by the inspection agency.
 2. Prevent unnecessary trips by inspection agencies. Should the Contractor call for a test or inspection by the Owner's agency and not have the work ready upon arrival, the Owner at his own discretion may: charge the Contractor for agency delay time or treat the inspection as a "retest/re-inspection."
- 1.10 Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Distribute schedule to Owner, Architect,

testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the date test or inspection was conducted, a description of the Work, date received and the identification of testing agency or special inspector conducting the test or inspection. Maintain log at Project site.

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. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
 - 1. Protect construction exposed by or for quality-control service activities.
 - 2. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS (CONTRACTOR OCCUPIED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Division 1 Sections "Project Coordination" for requirements related to Owner operations on site and protection of work in place, and to Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities required include but are not limited to:
 - 1. Temporary toilet facilities
- C. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary Project identification signs and bulletin boards.
 - 2. Waste disposal services.
 - 3. Erosion control facilities.
 - 4. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection.
 - 5. Plywood enclosures at all wall openings

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Electric Power and Gas Service: The Owner will pay for utility use bills during Construction. However, all fees for services must be directly related to the Work.
- C. Water and Sewer Service from Existing System: The Owner will pay for utility use bills during Construction. However, all fees for services must be directly related to the Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan (If requested by Architect or Owner): Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel. Coordinate with project phasing and project schedule as needed.
- B. Erosion- and Sedimentation-Control Plan (If requested by Architect, Engineer or Owner): Show compliance with requirements of authorities having jurisdiction, whichever is more stringent.
- C. Moisture-Protection Plan (For construction during wet weather season of October to May): Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage. Include protocols for mitigating water intrusion into completed Work. Indicate sequencing of work that requires water, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits and pay for all such tests and inspections.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1 and the State codes related to maintaining barrier free and emergency egress for existing facilities to remain occupied by Owner during construction.
- D. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. National Electrical Code (NEC, latest edition) and standards.
 - 4. Utility company regulations.
 - 5. Police, Fire Department and Rescue Squad rules.
 - 6. Environmental protection regulations.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload

facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials; or undamaged previously used materials in serviceable condition. Provide materials suitable for the use intended.
- B. Erosion Control Measures: Provide all materials required by local jurisdiction and the Contract Documents related to temporary storm water and erosion control.
- C. Polyethylene Sheet for Partitions and Dust Barriers: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
- D. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- E. 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.

2.2 TEMPORARY FACILITIES

- A. Storage and Fabrication Sheds: Provide sheds or cargo containers, sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible and hazardous materials apart from building and in compliance with regulations.
- B. Temporary Toilet Units: **Contractor shall provide temporary toilet facilities for workers on site and for Owner occupied trailer per 01 5100.** Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Toilet facilities in the existing buildings are not to be used by the Contractor.
- C. Hand Washing Units: Contractor shall provide temporary hand washing facilities for workers on site for Owner occupied trailer per 01 5100.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Provide dehumidification equipment as needed for space dry-out.
 - 2. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 3. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 4. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille

in system and remove at end of construction, and clean HVAC system as required in Division 01 Section "Closeout Procedures".

- C. Air Filtration Units for Dust or Air Quality Control: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.
- D. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shut-off nozzles at hose discharge.
- E. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- F. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- G. Lamps and Light Fixtures: Provide general service construction lights and lamps required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide wet location-rated fixtures where exposed to moisture.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work and include all costs in the Contract Sum.
 - 1. Locate facilities to limit site disturbance and within the clearing limits or site disturbance limits as applies.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Coordinate with Owner for access to all existing utilities on site and in the building. Provide as needed if not available.
- B. Water Service: Connect to site's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide chemical toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

- D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity.
- E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. 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.
 - 2. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Connection to the site's existing electric power service may be arranged at Owner's option. Maintain equipment in a condition acceptable to Owner.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- I. Telephone Service: Provide cellular service to Superintendent.
- J. Electronic Communication Service: Provide email capabilities on site to construction personnel:

3.3 SUPPORT FACILITIES INSTALLATION

- A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- B. Parking: Provide temporary parking areas for construction personnel that are separate from Owner designated parking facilities. Parking shall be at a remote location.
- C. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.
- D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Temporary Erosion and Sedimentation Control: Comply with requirements of authorities having jurisdiction and requirements specified in Contract Documents.
 - 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 2. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
 - 3. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Comply with requirements specified in Division 01 Section "Temporary Tree and Plant Protection," and the Drawings.
- E. Area of Work Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
 - 2. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- F. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- H. 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 gypsum wallboard on occupied side, or with two layers of 6-mil 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. Seal joints and perimeter. Provide walk-off mats at each entrance through temporary partition.

- I. 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. Prohibit smoking in construction areas.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
 6. Monitor and dewater enclosed spaces where water may collect.
 7. Mechanically ventilate, or dehumidify as needed, crawlspaces and similar enclosures.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 72 hours are considered potentially defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
- B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Materials and facilities that constitute temporary facilities are property of Contractor.
 - 1. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility.
 - 2. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 01 5000

SECTION 01 5100 - TEMPORARY FACILITIES AND CONTROLS (OWNER OCCUPIED)**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section specifies the requirements for the District's field office. The field office is to be placed at 1415 Freeway Drive. A second field office for the Contractor's use can be located at this location. Both of these field offices will need to have been approved building permits.
- B. The District's field office shall be the property of the Contractor and upon Final Acceptance of the Contract, the Contractor shall be responsible for its removal and disposition. The disturbed area(s) are to be restored to pre-construction condition as approved by the property owner.
- C. The District's field office is not for the use of the Contractor.
- D. The District's field office shall be installed and operational no later than 45 days after Notice to Proceed.

1.2 SUBMITTALS

- A. Scaled floor plan drawing for field office including furnishing and equipment layout.
- B. Product data for field office, furnishing, and equipment.
- C. Field office site location and site layout.

1.3 FIELD OFFICE

- A. Portable facility capable of being moved via public roadways with a manufacturing date of 2015 or newer that hasn't been smoked in. Any required moving permits shall be the responsibility of the contractor.
- B. Field office requirements:
 - 1. At a minimum the office shall include three enclosed offices each at least 150 sqft, one bathroom with a lavatory & water closet and necessary appurtenances, two work-stations in a central common area located in the remaining open portion of the office arranged to where this space can also double as a conference/meeting room. Each workstation shall each include: one desk, one computer table, one ergonomically adjustable office chair, one stationary chair, and one waste basket. The common area conference/meeting area shall have a conference table min. size (10' x 4') with eight ergonomically adjustable office chairs.
 - 2. A coffee station including a table, electrical receptacle, and bottled water dispenser that includes both hot and cold water.
 - 3. A standard size refrigerator min. 18 cu ft.
 - 4. Minimum of three windows with Venetian-type blinds.
 - 5. Connection for electrical service, internet service with a minimum of 200 mbs, communication and data backbone cabling to each workstation along with one additional location to be determined for the conference/meeting area, weekly water service, garbage and sanitation pumping service.
 - 6. Seismic tie-downs and skirting.
- C. Obtain all other required permits and comply with all federal, state, and local requirements.

1.4 POWER

- A. Procure all necessary L&I electrical permits required to connect the District's field office to the existing 100 AMP metered power service as shown per the attached plan. The service and associated monthly fees shall be transferred into the Contractor's name and paid by the Contractor. If the Contractor chooses to utilize this site to locate their field office and the existing 100 AMP service is not adequate to serve both offices, the Contractor shall coordinate with the power company and Labor & Industries to upgrade the existing overhead power service from 100-amp to a 200-amp service. All costs to provide power to the field office(s) will be included in the bid and paid for by the Contractor including any PSE installation charges.
- B. Provide power per IBC requirements and including an extra outlet for one copier.
- C. Meet all current electrical code requirements.
- D. Provide connections for computers (desktop) at each workstation and at the printer/fax area along with one additional location to be determined to serve the conference/meeting area.

1.5 HEATING, AIR CONDITIONING, AND VENTILATION

- A. Provide a quiet, functioning climate control system that provides heating, air conditioning, and ventilation. The system shall include the appropriate number of vents and return air ducts to provide an even distribution of air to all areas of the office space. At a minimum, each office space shall contain one HVAC air vent with adjustable damper.
- B. Per Skagit County Building Permit requirements, the HVAC unit must be an economizer unless the unit meets 21 SEER.

1.6 COMMUNICATION AND TELEPHONE SERVICE

- A. Provide and install Local Area Network (LAN) and data Backbone and Horizontal cabling that meets the following requirements:
 - 1. Provide LAN System backbone cabling circuits between the data/LAN closet and all outlet jacks as directed by the District. Provide and install two (2) circuits for each LAN outlet jack in the trailer. Cabling and terminations shall meet the requirements of EIA/TIA-568, Category 5.
 - 2. LAN system hardware to be provided and installed, complete with all terminations in the closet, shall include the following:
 - a. One (1) wall mounted 48 port Patch Panel, Category 5, approximately 6" H x 19" W Modular RJ45 to CAT 5 Connections.
 - b. One (1) sturdy shelf sufficient to support a portable computer and monitor.
 - c. Quadplex (4 jacks) Modular RJ45 at each workstation and printer/fax area and one additional area to be determined to serve the conference/meeting room area, with wall jacks color-coded to designate two data, one phone, and one spare.
 - d. All wiring clearly labeled with a numbering system at patch panel and wall jack.
 - 3. All equipment and installation work shall meet or exceed the requirements and recommended wiring practices of the EIA/TIA-568 Standard.
 - 4. Provide wiring and data jacks for each office work station and copier/printer/scanner as directed by the District. The District will provide telephones with voice mail service, the workstation computers, and the copier/printer/scanner.

1.7 WATER SERVICE

- A. Provide hot and cold drinking water dispenser and weekly replacement service of water bottles for all potable water use.

1.8 SANITARY FACILITIES

- A. Provide portable sanitary facility with hand wash outside of the office trailer in addition to the sanitary holding tank sized to serve the four workstations inside the office trailer. Comply with applicable laws, ordinances, and regulations including ADA pertaining to public health, sanitation and access.

1.9 SECURITY

- A. Provide on all exterior doors keyed lock sets and cylinder deadbolt locks that are keyed alike. Provide 3 sets of keys. The District field office is to be keyed separately from the Contractor's offices.
- B. All exterior doors shall provide suitable and appropriate security.
- C. All exterior office space windows shall correctly operate with a secure locking system.
- D. Exterior windows shall be secured with bars to prevent entry from the outside.

1.10 SITE PREPARATION

- A. Prepare level foundation site for placement of field office.

1.11 ROADS AND PARKING

- A. Maintain safe, open, and non-congested access at all times.
- B. Provide parking for a minimum of 5 vehicles.

1.12 CLEANING AND MAINTENANCE

- A. Provide cleaning and maintenance including:
 - 1. Twice weekly vacuuming, wet mopping, trash removal, and recycle removal.
 - 2. Twice weekly cleaning and pumping of sanitary holding tank(s) and provide restroom supplies on an as-needed basis.
 - 3. HVAC, water service, electrical, and communication line maintenance as required.
 - 4. Service and maintenance of all Contractor supplied office equipment.
- B. Maintain the area free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition, including vegetation and landscape areas.

1.13 OFFICE EQUIPMENT AND FURNISHINGS

- A. Provide and maintain office equipment and furnishings as follows:
 - 1. Provide 4 desks, 4 ergonomically adjustable computer tables, 4 ergonomically adjustable office chairs, 4 stationary chairs, and 4 waste baskets.
 - 2. One 48" x 120" folding tables with Formica top and 8 stacking metal chairs with cushioned vinyl or fabric pads for the conference room.
 - 3. One (1) four-drawer legal size filing cabinet and one (1) two-shelf bookcase.
 - 4. One drawing layout table and a plan rack.
 - 5. Evenly distributed, quality office lighting.
 - 6. Bottled drinking water service with hot and cold-water dispenser.
 - 7. Counter or table next to the owner-supplied printer, scanner, and copier.
 - 8. Owner-supplied Printer/Copier/Scanner: Ricoh MPC2003 or Approved Equal.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION****3.1 PARKING LOT**

- A. Maintain graveled areas by installing and rolling a minimum of 4 inches of 1-1/4" clean crushed rock to maintain a hard, permeable parking area. Skagit County Stormwater Code considers graveled areas as being impervious. Any increase in impervious area above and beyond the existing graveled areas triggers a Skagit County Stormwater Permit. If Skagit County Stormwater Permit is necessary, it will be the Contractor's responsibility to procure.
- B. Maintain traffic and parking areas in sound condition, free of excavated material, construction equipment, mud, debris and construction materials. Repair deficiencies including potholes and low areas which collect standing water.

3.2 ON-GOING COSTS

- A. Be responsible for all on-going maintenance and utility cost associated with the field office and its operation for items furnished per this Section.

3.3 RESTORATION

- A. After Final Acceptance of the Contract, the Contractor shall be responsible for the removal and disposition of the District's field office and removal of all temporary facilities, including appurtenances and construction materials, and restore area of parking lot and office trailers to pre-construction conditions.

END OF SECTION 01 5100

SECTION 01 57 23 – TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.
- B. The Stormwater Pollution Prevention Plan (SWPPP)

1.2 QUALITY CONTROL

- A. Conform to regulatory requirements.
- B. Conform to the SWPPP.
- C. Erosion control systems depicted on drawings are intended to be minimum requirements to meet anticipated site conditions.

1.3 SCHEDULE

- A. Required erosion control facilities must be constructed and in operation prior to land clearing and/or other construction to ensure that sediment-laden water does not enter the natural drainage system or otherwise be discharged from the site.
- B. Sediment facilities shall be maintained in a satisfactory condition until such time that clearing and/or construction is completed and potential for on-site erosion has passed.
- C. The implementation, maintenance, replacement and additions to the erosion control systems shall be the responsibility of the Contractor.

PART 2 - PRODUCTS

2.1 STRAW

- A. Be in an air-dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.
- B. Be seasoned before baling or loading and shall be acceptable to the Engineer.

2.2 QUARRY ROCK

- A. Rock for construction entrance(s), rip rap swale and sediment trap shall be sized in accordance with the Drawings.

- B. Crushed concrete, cement, or calcium chloride shall not be utilized.

2.3 GEOTEXTILE

- A. Geotextile for construction entrance(s), rip rap swale and sediment trap shall meet the following standards:
1. Grab Tensile Strength (ASTM D4632) 200 lbs min.
 2. Grab Tensile Elongation (ASTM D4632) 30% max.(woven)
 3. Puncture Strength (ASTM D6241) 495 lbs min.
 4. AOS (ASTM D4751) 20-45 (U.S. standard sieve size)

2.4 JUTE MATTING

- A. Be of a uniform open plain weave of unbleached, single jute yarn treated with a fire retardant chemical.
- B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than 1/2 of its normal diameter.
- C. Furnished in rolled strips 48 inches wide by approximately 50 yards long.
- D. Average weight of 0.92 pounds per square yard with an allowable tolerance of plus or minus 1 inch in width and 5% in weight.

2.5 STORM DRAIN INLET PROTECTION

- A. Use inserts designed by manufacturers for construction sites.
- B. Use materials as specified in the Drawings.

2.6 FILTER FABRIC

- A. Filter fabric for the erosion protection barriers shall meet the standards listed below. A copy of the manufacturer's fabric specifications must be available on site.

AOS (ASTM D4751)	30-100 sieve size (0.60-0.15 mm) for slit film 50-100 sieve size (0.30-0.15 mm) for other fabrics
Water Permittivity (ASTM D4491) 0	0.02 sec-1 minimum
Grab Tensile Strength (ASTM D4632) (see Specification Note 3)	180 lbs. min. for extra strength fabric 100 lbs. min. for standard strength fabric
Grab Tensile Elongation (ASTM D4632)	30% max. (woven)
Ultraviolet Resistance (ASTM D4355)	70% min.

2.7 WIRE

- A. Wire for the erosion protection barriers shall be 2 x 2 mesh, 14 gauge galvanized wire.

2.8 SUPPORT POSTS

- A. Support posts for the erosion protection barriers shall be 2 inch by 4 inch, Doug-FR No. 1 or better wood posts or 1-1/2 inch by 48 inch medium weight steel fence posts.
- B. Support posts materials may be as specified in the Drawings.

2.9 CLEAR PLASTIC COVERING

- A. Clear plastic covering for protection of slopes and cuts shall meet the requirements of the NBS Voluntary Product Standard, PS 17 for Polyethylene sheeting having a minimum thickness of 6 mil.

2.10 CONCRETE WASHOUT AREAS

- A. Above or below grade washout areas and prefabricated concrete washout containers shall meet the material requirements as described in Stormwater Management Manual for Western Washington.

2.11 SPILL PREVENTION KITS

- A. Spill kits shall, at a minimum, include the following materials:
 - 1. 1-Water Resistant Nylon Bag
 - 2. 3-Oil Absorbent Socks 3"x 4'
 - 3. 2-Oil Absorbent Socks 3"x 10'
 - 4. 12-Oil Absorbent Pads 17"x19"
 - 5. 1-Pair Splash Resistant Goggles
 - 6. 3-Pair Nitrile Gloves
 - 7. 10-Disposable Bags with Ties
 - 8. Instructions for use

2.12 CONSTRUCTION STORMWATER CHEMICAL TREATMENT

- A. Chemically treated stormwater discharged from construction sites must be nontoxic to aquatic organisms. The Chemical Technology Assessment Protocol (CTAPE) must be used to evaluate chemicals proposed for stormwater treatment. Only chemicals approved by the Washington State Department of Ecology under the CTAPE may be used for stormwater treatment. The approved chemicals, their allowable application techniques (batch treatment or flow-through treatment), allowable application rates, and conditions of use can be found at the Department of Ecology Emerging Technologies website: <http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html>.

2.13 SEDIMENT RETENTION WATTLE

- A. Wattles shall be a straw-filled tube of flexible netting material exhibiting the following properties. It shall be a machine-produced tube of compacted rice straw that is Certified Weed Free Forage, by a manufacturer whose principle business is wattle manufacturing. The netting shall consist of seamless, high-density polyethylene and ethyl vinyl acetate and contain ultra violet inhibitors.

PART 3 - EXECUTION

3.1 EROSION CONTROL

- A. Erosion control provisions shall meet or exceed the requirements of the local agency having jurisdiction.
- B. When provisions are specified and shown on the Drawings, they are the minimum requirements.
- C. Contractor shall not permit sediment laden waters to enter drainage facilities or be discharged from the site.
- D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the Contractor to address new conditions that may be created and to provide additional facilities over and above minimum requirements as may be required.

3.2 CONSTRUCTION ENTRANCE

- A. The entrance(s) shall be constructed on a firm, compacted subgrade.
- B. If the entrance is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash. If washing is used, it shall be done on an area covered with crushed rock, and wash water shall drain to a sediment trap or pond.
- C. Any quarry spalls that are loosened from the pad and end up on the roadway shall be removed immediately.
- D. If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing shall be installed to control traffic.
- E. Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

3.3 INTERCEPTOR SWALES

- A. Interceptor swales shall be sized and located in accordance with the Drawings.
- B. Swales shall discharge to a stable conveyance system that routes the runoff to a sediment pond or trap.
- C. Damage resulting from runoff or construction activity shall be repaired immediately.
- D. If the facilities do not regularly retain storm runoff, the capacity and/or frequency of the dikes/swales shall be increased.

3.4 SEDIMENT TRAP

- A. Sediment traps shall be installed on site to de-silt all stormwater or water pumped from excavations.
- B. Sediment traps shall be sized and located in accordance with the Drawings.

- C. To aid in determining sediment depth, all traps shall have a staff gage with a prominent mark one foot above the bottom of the trap.
- D. Sediment shall be removed from the trap when it reaches 1 foot in depth.
- E. Any damage to the trap embankments or slopes shall be repaired.

3.5 FILTER FABRIC FENCES

- A. Filter fabric fence shall consist of filter fabric fastened to wire fabric with staples or wire rings.
- B. Wire shall be fastened to posts set at 6-foot centers maximum.
- C. Fabric shall be buried into ground approximately 8 inches to prevent silt from washing under fabric.
- D. Fence shall be located to catch silt and prevent discharge to drainage courses.
- E. Where the fence is installed, the slope shall be no steeper than 2H:1V.
- F. Any damage shall be repaired immediately.
- G. If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment trap or pond.
- H. Check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.
- I. Sediment shall be removed when the sediment is 6 inches high.
- J. If the filter fabric has deteriorated due to ultraviolet breakdown, it shall be replaced.

3.6 STRAW BALE FILTER

- A. Installed in drainage way to catch silt.
- B. Dig bales into ground approximately 6 inches and stake in place with 2 wooden stakes in each bale.
- C. Bales to extend above anticipated surface of stream.

3.7 SEDIMENT RETENTION WATTLE

- A. Wattles shall be installed perpendicular to the flow direction
- B. Narrow trenches shall be dug to a depth of 3 to 5 inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and during high rainfall events, the trenches should be dug to a depth of 5 to 7 inches, or $\frac{1}{2}$ to $\frac{2}{3}$ of the thickness of the wattle.
- C. Install wattles in the trench, insuring that no gaps exist between the soil and the bottom of the wattle. The ends of adjacent wattles should be tightly abutted so that no opening exists for water or sediment to pass

through. Alternately, wattles may be lapped, 6" minimum to prevent sediment passing through the field joint.

- D. Wooden stakes should be used to fasten the wattles to the soil at 4-foot centers. When conditions warrant, a straight metal bar can be used to drive a pilot hole through the wattle and into the soil.
- E. Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.
- F. Inspect wattles prior to forecasted rain, daily during extended rain events, after rain events, weekly during the wet season, and at two-week intervals at all other times of the year.
- G. Repair or replace split, torn, raveling, or slumping wattles
- H. Remove sediment accumulations when exceeding $\frac{1}{2}$ the height between the top of the wattle and the ground surface.

3.8 PLACING JUTE MATTING

- A. Seed and fertilizer shall be placed prior to placing of matting.
- B. Jute matting shall be unrolled parallel to the flow of water. Where more than 1 strip of jute matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.
- C. The up-slope end of each strip of matting shall be staked and buried in a 12-inch wide by 6-inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (1 stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.
- D. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.
- E. Check slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as upslope ends. Check-slots must be spaced so that one check slot or one end occurs within each 50 feet of slope.
- F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.
- G. Matting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and check slots shall be fastened at 6-inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

3.9 PLACING CLEAR PLASTIC COVERING

- A. Clear plastic covering shall be installed on erodible embankment slopes as shown in the plans or as designated by the Engineer.

- B. The clear plastic covering shall be installed immediately after completion of the application of roadside seeding.
- C. The Contractor shall maintain the cover tightly in place by using sandbags or tires on ropes with a minimum 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12-inch overlap of all seams.
- D. The Contractor shall be responsible to immediately repair all damaged areas.
- E. The clear plastic covering shall be replaced or removed within 6 months of installation.

3.10 STORM DRAIN INLET PROTECTION

- A. Any accumulated sediment on or around inlet protection shall be removed immediately. Sediment shall not be removed with water, and all sediment must be disposed of as fill on site or hauled off site.
- B. Any sediment in the catch basin insert shall be removed when the sediment has filled one-third of the available storage. The filter media for the insert shall be cleaned or replaced at least monthly.

3.11 EXISTING DRAINAGE FACILITIES

- A. Should a storm sewer or culvert become blocked or have its capacity restricted due to discharge siltation from Contractor's operations, the Contractor shall make arrangements with the jurisdictional agency for the cleaning of the facility at no additional expense to the Owner.

3.12 DRAINAGE DIVERSION

- A. Contractor shall divert the surface runoff water around the site as may be required.
- B. Drainage shall be restored to condition existing prior to construction unless otherwise shown on the Drawings.

3.13 SAWCUTTING

- A. Vacuum slurry and cuttings during cutting and surfacing operations.
- B. Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- C. Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- D. Dispose of collected slurry and cuttings in a manner that does not violate ground water or surface water quality standards.
- E. Do not allow process water generated during hydro-demolition, surface roughening or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose process water in a manner that does not violate ground water or surface water quality standards.

- F. Handle and dispose cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.
- G. Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and vacuum trucks.

3.14 CONCRETE WASHOUT AREAS

- A. Locate washout area at least 50 feet from sensitive areas such as storm drains, open ditches, or water bodies, including wetlands.
- B. Allow convenient access for concrete trucks, preferably near the area where the concrete is being poured.
- C. If trucks need to leave a paved area to access washout, prevent track-out with a pad of rock or quarry spalls. These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- D. Concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations
- E. Concrete washout from concrete pumper bins may be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of off-site
- F. Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis
- G. Temporary Above-Grade Concrete Washout Facility:
 - 1. Temporary concrete washout facility (type above grade) should be constructed with a recommended minimum length and minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
 - 2. Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material
- H. Temporary Below-Grade Concrete Washout Facility:
 - 1. Temporary concrete washout facilities (type below grade) should be constructed with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
 - 2. Lath and flagging should be commercial type.
 - 3. Plastic lining material shall be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
 - 4. Liner seams shall be installed in accordance with manufacturers' recommendations.
 - 5. Soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
- I. Assure that washout of concrete trucks, chutes, pumps, and internals is performed at an approved offsite location or in designated concrete washout areas. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams.

- J. Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas.
- K. Wash off hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels into formed areas only.
- L. Wash equipment difficult to move, such as concrete pavers, in areas that do not directly drain to natural or constructed stormwater conveyances.
- M. Do not allow washdown from areas, such as concrete aggregate driveways, to drain directly to natural or constructed stormwater conveyances.
- N. Inspect and verify that concrete washout BMPs are in place prior to the commencement of concrete work.
- O. During periods of concrete work, inspect daily to verify continued performance.
 - 1. Check overall condition and performance.
 - 2. Check remaining capacity (% full).
 - 3. If using self-installed washout facilities, verify plastic liners are intact and sidewalls are not damaged.
 - 4. If using prefabricated containers, check for leaks.
- P. Washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Q. Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- R. If the washout is nearing capacity, vacuum and dispose of the waste material in an approved manner.
 - 1. Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
 - 2. Do not use sanitary sewer without local approval.
 - 3. Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to predicted wet weather to prevent accumulation and overflow of precipitation.
 - 4. Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused on-site or hauled away for disposal or recycling.
- S. When material is removed from the self-installed concrete washout, a new structure must be built; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.
- T. When temporary concrete washout facilities are no longer required for the work, the hardened concrete, slurries and liquids shall be removed and properly disposed of.
- U. Materials used to construct temporary concrete washout facilities shall be removed from the site of the work and disposed of or recycled.
- V. Contain wash water and leftover product in a lined container when no formed areas are available. Dispose of contained concrete in a manner that does not violate ground water or surface water quality standards.
- W. Check containers for holes in the liner daily during concrete pours and repair the same day.
- X. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled, repaired, and stabilized to prevent erosion.

3.15 SPILL PREVENTION

- A. Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- B. Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- C. Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- D. Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be nonhazardous.
- E. Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- F. During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- G. Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).

3.16 PH CONTROL FOR HIGH PH WATER

- A. Neutralization of high pH stormwater runoff shall be executed in accordance with the Stormwater Management Manual for Western Washington.

3.17 CONSTRUCTION STORMWATER CHEMICAL TREATMENT

- A. Execution of construction stormwater chemical treatment shall be in accordance with the Stormwater Management Manual for Western Washington.

END OF SECTION 01 56 39

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 01 Section "Substitution Procedures" for requests for substitutions.
 - 2. Division 01 Section "References" for applicable industry standards for products specified.

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.

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 the substitution review 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 proprietary or semi-proprietary specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," "listed or specified product," or similar language, and including make or model number or other designation.
- C. Proprietary Specification: A type of product specification which names a single manufacturer and product or system with no language indicating that comparable products are permitted. This type of specification is used on private projects. The products may be indicated in the specification or the drawings.
- D. Semi-proprietary Specification: A type of product specification in which a specific manufacturers product or system is indicated by name (as a 'Basis of Design Product') accompanied by the term

"or comparable approved," "or approved equal," or similar language. This type of specification allows for suppliers to submit other products and systems for approval under substitution process.

- E. Performance or Descriptive Specification: A type of product specification in which no specific product is named. Products are provided that must meet the performance requirements that describe a product or assembly by listing the exact characteristics required, with or without use of a brand or trade name. This is also known as an "open specification."

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents.
- B. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents. Unless otherwise agreed to by the Owner, manufacturers that have standard warranty language, disclaimers and/or limitations in conflict with the Contract Documents must modify their warranty to fully comply.
- C. Comply with requirements in Division 01 Section "Warranties." Refer to Divisions 02 through 49. Sections for specific requirements for special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

B. Product Selection Procedures:

1. Proprietary Specification Requirements: 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. Semi-proprietary Specification Requirements: When a product and/or manufacturer is indicated by name as a 'Basis of Design Product', accompanied by the term "or comparable approved" or "or approved equal," provide the indicated product/manufacturer or comparable product/manufacturer after complying with the substitution requirements in "Comparable Products" paragraph to obtain approval for use of an unnamed product.
 - a. This also applies where two or more products or manufacturers are named, and where a specific product is indicated on Drawings.
 - b. Where named products or systems are accompanied by a list of manufacturers, provide the specified or indicated product or an approved (by Architect) comparable product by another manufacturer. The list of manufacturers may be either a restricted list or an unrestricted list.
 - c. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comparable products must conform to these characteristics.
 - d. The product or system is designated 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. Comparable products must conform to the qualities of the named product and all performance characteristics of the specification.
 3. Performance and Descriptive Specification Requirements: Where Specifications require compliance with performance requirements, describe a product or assembly by listing exact characteristics required, with or without use of a brand or trade name: provide a product or assembly that provides the characteristics indicated in the specifications, on the drawings and as otherwise complies with Contract requirements.
 - a. Restricted List: Where Specifications include a list of names of manufacturers and/or 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. Non-restricted List: Where Specifications include a list of names of 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.
- 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.
- 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. Comparable Product Requests: Submit to the Architect a request for consideration of each comparable product. Comply with the substitution requirements in Division 01 Section "Product Substitutions." Identify product or system or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Show compliance with all performance requirements of the specification
 - 2. Demonstrate that the proposed product is equal or better than that named (Basis-of-Design) product.
 - 3. Include a fully completed Substitution Request Form.
- B. Timing of Comparable Product Requests: Comparable Product Requests are normally submitted and reviewed during bidding. If approved, the comparable product becomes a "named" product that may be used in the work subject to compliance with the submittal procedures in Division 01 Section "Submittal Procedures". After award of the contract, comparable products may only be reviewed and approved if there is a demonstrable benefit to the Owner. The Architect and Owner are under no obligation to approve a comparable product during construction. The Contractor may be required to provide the named product or system.
- C. Conditions for Consideration: Architect will consider Contractor's request for comparable product in accordance with Division 1 Section "Product Substitutions."

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 6030 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and other Division-1 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 01 Section "Product Requirements" for information on types of product specifications and product selection.
 - 2. Division 01 Section "References" for applicable industry standards for products specified.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract. Several requirements of this Section also apply to substitutions during the bid period as described in the "Instructions to Bidders."
- B. This section applies to all reviews of comparable products related to Semi-proprietary Specifications as described in Division 01 Section "Product Requirements." The procedures herein also apply to reviews of unnamed manufacturers, suppliers, products, and systems related to listings in Performance and Descriptive Specifications.

1.3 DEFINITIONS

- A. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor or Bidder, which include:
 - 1. Those proposed by bidders prior to award of the contract.
 - 2. Those changes proposed by the Contractor after award of the Contract.
- B. Types of Substitutions: Substitutions fall into two categories based upon the timing of submission.
 - 1. Bid Period: During bid period, request for substitutions will be considered if received as indicated in the "Instructions to Bidders." Substitutions for Semi-Proprietary Specifications will be considered as a "comparable product" as described elsewhere.
 - 2. During Construction: After Award of the Contract, requests for substitution may be considered or rejected outright at the discretion of the Owner/Architect.
- C. Non-Substitutions: The following are not considered substitutions:
 - 1. Revisions to Contract Documents requested by the Owner or Architect.
 - 2. Specified options of products and construction methods included in Contract Documents.

3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTAL REQUIREMENTS FOR ALL SUBSTITUTIONS

- A. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
- B. Include a completed copy of the "Substitution Request Form" included at the end of this section. All information is required. Incomplete forms shall be cause for rejection of the Substitution Request, as determined by the Architect.
 1. Substituted products and systems often have differences that will impact other materials and surrounding construction which necessitates additional design time and construction changes. Such impacts must be identified in the submittal and on the form. Failure to do so and accept financial responsibility for redesign will result in rejection of the request.
- C. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate or requested:
 1. Complete Product Data, including Drawings and descriptions of all products, fabrication and installation procedures.
 2. Standard details, drawings, fabrication drawings, etc.
 3. Standard Specifications, material data sheets, etc.
 4. Qualification Data.
 5. Test Reports for compliance with performance and quality assurance requirements.
 6. Samples, where applicable or requested.
 7. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance, warranty and visual effect.
 8. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
 9. For construction phase requests, a statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 10. Cost information for construction phase requests, including a proposal of the net change, if any, in the Contract Sum.
 11. Certification by the Contractor/Proponent that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, which may subsequently become necessary because of the failure of the substitution to perform adequately.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONDITIONS FOR APPROVAL OF COMPARABLE PRODUCT SUBSTITUTIONS

- A. Conditions for Review: “Comparable Product” substitution requests submitted during the Bid Phase will be received by the Architect and considered 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. During Construction, “Comparable Product” substitution requests must also meet the conditions of Paragraph 3.2, “Criteria and Conditions for Approval During Construction.”
1. Evidence that the proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Included is a 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, color and finish selection, and specific features and requirements indicated.
 3. Evidence that proposed product provides the specified and comparable warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

3.2 CRITERIA AND CONDITIONS FOR APPROVAL DURING CONSTRUCTION

- A. Conditions for Review: During construction, the Contractor's substitution request will be received by the Architect and considered only when one or more of the following conditions are satisfied, as determined by the Architect. Substitution Requests that do not satisfy the conditions will be returned without action, except to record noncompliance with these requirements. The Contract will be required to provide the manufacturer, material, product, fabrication, or system indicated in the Contract Documents.
- B. Conditions for review are:
1. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of Contractor's failure to produce submittals promptly, submit orders in a timely fashion, pursue the Work promptly or coordinate activities properly.
 2. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 3. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
 4. The specified product or method of construction is incompatible with or cannot be coordinated with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

5. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
6. The request is directly related to an “or comparable approved” "or approved equal" clause or similar language in the Contract Documents.

3.3 ARCHITECT REVIEW

- A. The Contractor's substitution request will be evaluated by the Architect for the following:
 1. Compliance with the Conditions for Review above.
 2. Extensive revisions to Contract Documents are not required.
 3. Proposed changes are in keeping with the general intent of Contract Documents.
 4. The request is timely, fully documented and properly submitted.
 5. The request is comparable to the specified manufacturer, product or system in performance, quality, size, dimension, and any other significant characteristic, as determined by the Architect.
 6. The requested substitution is visually compatible with the design intent of the Contract Documents.
 7. The substitution is of comparable value to the Owner, or an equitable adjustment is negotiated in contract sum or time.
- B. The Architect, in consultation with the Owner, will make a determination in accordance with Division 01 Section “Submittal Procedures” and respond as follows:
 1. During Bid: By addendum to all parties on the plan holders list. Substitutions requested by Bidders during the bidding period, and accepted through Addenda prior to award of Contract, are considered as included in the Contract Documents and are not subject to evaluation under this Section after award.
 2. During Construction: By Change Order (C.O.), Construction Change Directive (CCD), or Architect’s Supplemental Instruction (ASI) whichever applies.

END OF SECTION 01 6030

SUBSTITUTION REQUEST FORM

To: _____

Project: _____

We hereby submit for consideration the following product instead of the specified item for the above project:

Section: _____ Specified Item: _____

Proposed Substitution: _____

Attach complete technical data, including laboratory tests and samples, as applicable. Compare the significant qualities (size, weight, durability, performance and similar characteristics, and including visual effect where applicable) of the proposed substitution with the original requirements. List complete installation changes and changes to Drawings and Specifications required by proposal.

Fill in blanks below:

A. Does substitution require changes in Drawing dimensions? _____

B. Will Undersigned pay for resulting building design changes including engineering and detailing costs?

C. What effect does substitution have on other trades? _____

D. Differences between proposed substitution and specified item: _____

E. Manufacturer's guarantees of proposed and specified items are: _____ Same _____ Different (explain on attachment)

F. Name and address of three similar projects on which product was used as well as date of installation:

G. Contract completion date is: _____ Same _____ Different

Undersigned attests function and quality is equivalent or superior to specified item and waives their right to additional payment and time which may subsequently be necessitated by failure of the substitution to perform adequately and for the required work to make corrections thereof.

Submitted by:

_____ Signature	Date _____	For use by Architect: ____ Accepted ____ Accepted as Noted ____ Not Accepted ____ Received Too Late By _____ Date _____
_____ Firm	Phone _____	
_____ Address	Fax _____	
	Email _____	

SECTION 01 7700 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A This Section specifies administrative and procedural requirements for project closeout, including but not limited to: inspection procedures, project record document submittal, operating and maintenance manual submittal, submittal of warranties, and final cleaning.

1.3 SUBSTANTIAL COMPLETION

- A Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. The Contractor shall prepare a punch list of work items known to be incomplete. Provide this list prior to the scheduled inspection. Refer to Article on "Contractor' List of Incomplete Items."
2. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items and the value of incomplete construction. Coordinate and include value of punch list work.
 - b. Prepare and submit all lien releases and supporting documentation not previously submitted and accepted. Account for final additional changes to the contract sum.
3. Obtain and submit jurisdictional releases, certificate of occupancy (C of O) or temporary certificate of occupancy (TCO) enabling the Owner unrestricted use of the Work. Provide releases for access to all services and utilities. Include occupancy permits, inspection reports, operating certificates and similar releases.
4. Complete start-up testing and balancing of systems, and instruction of the Owner's operating and maintenance personnel.
5. Discontinue or change over and remove owner-occupied or construction support temporary facilities from the site, along with construction tools, temporary facilities, and similar elements. Owner-occupied temporary facilities will be maintained for 14 days following date of substantial completion to accommodate the owner's moving process. All temporary facilities will be changed over and removed along with completion of punch list items.
6. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
7. Deliver tools, spare parts, extra stock, and similar items.

- B Inspection Procedures: On receipt of a request for inspection, the Architect, Owner and Consultants will proceed with inspections or advise the Contractor of unfilled requirements. The Architect will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. If substantially complete, the Architect will within 7 days of the inspection prepare the Certificate of Substantial Completion (dated the day of the inspection), and forward to the Contractor with punch lists attached.

1. If inspections by subconsultants or the Owner do not occur simultaneously, the 7 day period begins on the date of the last of the inspection.
2. The Architect will repeat inspection when requested and assure that the Work has been substantially completed.
3. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 CONTRACTOR'S 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. Attach to request for substantial completion inspection.
1. Organize list of spaces in order, and organize items applying to each space by major element categories.
 2. Submit list of incomplete items in PDF electronic file format (MS Word or PDF), or Three (3) paper copies of list, unless otherwise indicated.

1.5 PHYSICAL COMPLETION

- A Preliminary Procedures: Before requesting determination of physical, complete the following. List exceptions in the request.
1. Submit an annotated copy of the Architect's inspection 'punch' list(s) of items to be completed or corrected, showing how each item has been completed or otherwise resolved for acceptance.
 2. Submit all information necessary to complete Construction Change Directives and Change Orders so that final contract sum and time is known.
 3. Prepare and submit a physical completion payment application identifying all work as 100% complete. No payment will be made until all items, except for administrative items included for final acceptance, are complete.
 4. Deliver tools, spare parts, extra stock, and similar items.
 5. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
 6. Complete and document all remaining items under the Substantial Completion list.
 7. Advise Owner of pending insurance change-over requirements. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B Reinspection Procedure: The Architect will inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed.
1. Upon completion of inspection, the Architect will make a determination of Physical Completion or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required prior to Physical Completion.
 2. If necessary, inspection will be repeated.
 3. For more than one Physical Completion inspection and/or for more than one final inspection, the Contractor shall reimburse the Owner at standard billing rates for the Architect's services.

1.6 FINAL COMPLETION/FINAL ACCEPTANCE

- A Preliminary Procedures: Before requesting final completion/final acceptance certification and final payment, complete the following. List exceptions in the request.
1. Submit complete list of any items shown as not yet completed in either Substantial Completion or Physical Completion documentation. Indicate date of completion and how each item has been completed or otherwise resolved for acceptance.
 2. Prepare and submit the final payment application with all lien releases and supporting documentation not previously submitted and accepted. Account for final additional changes to the Contract Sum.
 3. Submit Retainage Pay Application. On public works contracts, coordinate with Owner for submission of State documentation for completion of public works contracts.
 4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information, and as required under Section 01 7700 1.7.
 6. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
 7. Submit final commissioning reports.
 8. Submit consent of surety to final payment.
 9. Submit a final liquidated damages settlement statement, if any.

1.7 RECORD DOCUMENT SUBMITTALS

- A General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours. Upon completion of the Work, submit record documents to the Architect for the Owner's records.
- B Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.
 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- C Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written Contract Documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

- D Record Product Data and Sample Submittal: Maintain one copy of each Product Data submittal. Mark these documents and submit as necessary to show significant variations in actual Work performed in comparison with information submitted. Note related Change Orders and mark-up on record drawings and Specifications. Meet with the Architect and the Owner to determine which of the submitted are to be transmitted to the Owner for record purposes.
- E Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work.
- F Operation and Maintenance Manuals: Organize operating and maintenance data and other data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.
1. Include the following types of information:
 - a. Spare parts list.
 - b. Copies of warranties.
 - c. Wiring diagrams.
 - d. Recommended "turn around" cycles.
 - e. Shop Drawings and Product Data.
 - f. Fixture lamping schedule.
 - g. Operating Instructions
 - h. Maintenance Procedures
 - i. Balancing reports and commissioning reports
 - j. Manufacturer Data, Contacts and Warranties
 2. Submit three (3) sets of Operation and Maintenance Manuals to the Architect for the Owner's records.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A Operating and Maintenance Training of Owner's Personnel: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the operation and required maintenance of the equipment.
1. Provide training for equipment and systems as specified elsewhere. If not otherwise indicated, provide training for the following equipment and systems as applicable:
 - a. Motorized doors, including sectional overhead doors and operators, overhead coiling doors, overhead coiling grilles and automatic entrance doors.
 - b. HVAC equipment, including air-handling equipment, air distribution systems, ventilation fans, heat pumps, radiant heat distribution, condensers, pumps, distribution piping, and terminal equipment and devices.
 - c. HVAC instrumentation and controls.
 - d. Conveying systems, including elevators, lifts and cranes.
 - e. Sprinkler and other fire suppression systems.

- f. Fire and security alarm systems and access control.
- g. Plumbing equipment; pumps, sumps, etc.
- h. Equipment, including projection screens, material handling equipment, loading dock equipment, residential appliances, motorized blinds and motorized louver and window operators.
- i. Electrical service and distribution, including transformers, switchboards, panel-boards, uninterruptible power supplies and motor controls.
- j. Electrical and lighting fixtures and controls.
- k. Phone and data systems.
- l. Emergency generator & transfer switch.
- m. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data equipment.
- n. Plant maintenance and irrigation system.

2. Include a detailed review of the following items:

- a. Maintenance, cleaning and operations manuals.
- b. Record documents and identification systems
- c. Spare parts, tools and materials.
- d. Lubricants, Fuels and Hazards.
- e. Operation and control sequences.
- f. Warranties and bonds.
- g. Maintenance agreements and similar continuing commitments.

3.2 FINAL CLEANING

- A General: Ongoing cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B Final Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Complete the following cleaning operations
 - 1. Remove labels that are not permanent labels.
 - 2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - 3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - 4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - 5. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- D Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

- E Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

3.3 TIMING OF CLOSEOUT ACTIVITIES

- A Coordinate Substantial Completion, Physical Completion and Final Acceptance with the Owner's regularly scheduled meetings. Both milestones require Owner's Board approval prior to related releases and payments to the Contractor.

END OF SECTION 01 7700

SECTION 01 7800 – WARRANTIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.
 - 1. Refer to the General Conditions for additional terms of the Contractor's general warranty of workmanship and materials.
 - 2. General closeout requirements are included in Division 01 Section "Project Closeout."
 - 3. Special Warranties for the Work, products and installations are included in the individual Sections of Divisions 02 through 33. Commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for required by the Contract Documents, including:
 - 1. Contractor's comprehensive warranty on materials and workmanship,
 - 2. Manufacturers standard warranties
 - 3. Special warranties on materials, products, systems and installations.

1.3 SUBMITTALS

- A. Submittal Time: Submit written warranties during project closeout. Submit draft copy of warranties sufficiently in advance of final acceptance to allow for review. Architect will review for compliance with the Contract Documents with 14 days of receipt and return for revision, if necessary, and inclusion with other record documents.
 - 1. At contractor's option, the draft warranty documents may be scanned and submitted as a single indexed electronic PDF file with links enabling navigation to each item.
- B. Final written warranty certificates shall be signed originals that specify the project name, Owner's name, covered work or content, term and date of commencement. No photocopied or non-specific warranties will be accepted.
- C. Organize final approved warranty documents into an orderly sequence based on the table of contents of the 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. Provide table of contents at beginning of document. Identify item name, and name of Contractor, subcontractor, manufacturer or supplier of the warranty.
- D. Provide additional copies of each final warranty to include in operation and maintenance manuals

1.4 GENERAL WARRANTY REQUIREMENTS

- A. Disclaimers and limitations: Manufacturer's or subcontractor's disclaimers and limitations on product warranties do not relieve the contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the contractor.
- B. Rejection of Warranties: The Owner through the Architect reserves the right to reject warranties not in compliance with the Contract Documents, and to reject the work covered by the non-complying warranty unless the warranty is revised to comply.
- C. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- D. Reinstatement of warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty.
- E. Replacement cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of contract documents. The contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the owner has benefited from use of the work through a portion of its anticipated useful service life.
- F. Owner's recourse: Written warranties made to the owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the owner can enforce such other duties, obligations, rights, or remedies.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 CONTRACTOR'S GENERAL MATERIAL AND WORKMANSHIP WARRANTY

- A. Provide General Contractor's written warranty covering all installed products, materials system and workmanship from defects and faulty installation.

1. Term of Warranty: As stated in the General Conditions, or if not thus indicated: One (1) year from Final Acceptance of the work. This and any other warranty time limitations are in addition to and do not limit Contractor's warranties of fitness or the requirement that all Work including equipment and material meet the requirements of the Contract Documents.
 2. Conflicts with other Sections: Where Drawings or other Technical Specification Sections in the Project Manual refers to a conflicting length of warranty or starting date for the Contractor's or subcontractor's general material and workmanship warranty, the longer period shall govern.
- B. Partial Occupancy: When a designated phase or portion of the Work is completed, occupied and used by the Owner during the construction period, warranties may by separate agreement with the Owner and Contractor become effective prior to the time stated above. Submit properly executed warranties for review and acceptance in accordance with the Paragraph on Submittals. Such warranties shall carry a specific date as negotiated between the Owner and Contractor. Partial Substantial Completion completed does not constitute Substantial Completion of the Project.
- C. Included Work: This warranty applies to the General Contractor and all subcontractors and suppliers. Separate warranties shall be secured from all subcontractors and major system manufacturers and suppliers for their work, as determined by Owner.
1. The General Contractor's warranty statement shall specifically state that it covers all work whether or not subcontractors or supplier honor their warranties.

3.2 MANUFACTURER'S STANDARD AND SPECIAL WARRANTIES

- A. The contract documents require that standard and special warranties be executed by the Suppliers and Manufacturers of various materials, components, products, equipment, systems, etc. The warranties cover, but are not limited to, such elements as finish, operation, weather protection, defect, workmanship and installation by subcontractors, suppliers or manufacturers. Prepare signed original written warranty documents that contain the required content and meet requirements.
1. Submit properly executed warranties for review and acceptance in accordance with the Paragraph on Submittals.
 2. Refer to individual Sections of Divisions 02 through 33 for specific requirements for content, length (term) of warranty and special conditions for standard warranties.
 3. Commencement of Warranties: Manufacturer' and Supplier's standard warranties shall commence with Substantial Completion as established by the Architect, unless an alternate date is established per Paragraph 3.1, B above.

3.3 SPECIAL INSTALLER WARRANTIES

- A. The contract documents require various special warranties be executed by the Contractor, or by subcontractors. Prepare written warranty documents that contain

appropriate terms and project identification, ready for execution by the required parties. Submit to the Owner through the Architect for review and approval prior to final execution.

1. Submit properly executed warranties for review and acceptance in accordance with the Paragraph on Submittals.
2. Refer to individual Sections of Divisions 02 through 33 for specific content requirements, and requirements for submittal of special warranties.
3. Commencement of Warranties: Special warranties shall commence with Final Acceptance as established by the Owner, unless an alternate date is established per Paragraph 3.1, B above.

END OF SECTION 01 7800

SECTION 02 4119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.

- B. Related Requirements:

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse or store as indicated in plans.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at **Project site**.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. As indicated in drawings.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use and included in the Project Manual. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. **Engage a professional engineer to perform** an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

- F. Survey of Existing Conditions: Record existing conditions by use of **measured drawings, preconstruction photographs or video and templates.**
1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain fire watch during and for at least **8** hours after flame-cutting operations.
 - 6. Maintain adequate ventilation when using cutting torches.
 - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."
- D. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area **on-site**.
 5. Protect items from damage during transport and storage.
- E. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition **and cleaned** and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." **Do not use methods requiring solvent-based adhesive strippers.**
- F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 03 3000 - 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.
- B. Related Requirements:
 - 1. Civil drawings for Concrete Paving
 - 2. Structural Drawings General Notes Sheets S-001 and S-002

1.2 SUBMITTALS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Product Data: For each type of product.
- C. Qualification Data: For Installer

1.3 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.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage owners testing agency to perform preconstruction testing on concrete mixtures.

1.5 FIELD CONDITIONS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.2 FORM-FACING MATERIALS

- A. Per Architectural Plans, exterior concrete walls are to have a uniform tie (or faux tie) pattern. All surfaces are to have a Grout-Cleaned Finish (Sack and Patch).

2.3 STEEL REINFORCEMENT

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.4 REINFORCEMENT ACCESSORIES

- A. See Structural Drawings General Notes Sheets S-001 and S-002.

2.5 CONCRETE MATERIALS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Chemical Admixtures: Provide admixtures as recommended by the manufacturer that are certified to be compatible with other admixtures and that will 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.
- C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Available Manufacturers:
 - a. Davis Colors.
 - b. Increte
 - c. Lambert Corporation.
 - d. Scofield, L. M. Company.
 - 2. Basis of Design Product: Subject to compliance with requirements, provide pigments from Increte Systems, Inc., Color-Crete, or comparable product by one of the Available Manufacturers and approved in accordance with Section 01 6000, "Substitutions".
 - a. Dosage: Add at the manufacturer's prescribed dosage rate to achieve the selected color. Dosage rate is based upon the total weight of Portland cement, fly ash, silica fume, lime and other cementitious materials.
 - b. Color: As selected by Architect from manufacturer's full range.

2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A.(10-MIL) Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. For purposes of establishing minimum performance standards, this specification is based on the following: Stego Wrap Class A Vapor Retarder (10-MIL)

2.8 RELATED MATERIALS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Expansion and Isolation-Joint-Filler Strips: ASTM D 8139 semi-rigid closed-cell poly propylene foam.

2.9 CONCRETE MIXTURES, GENERAL

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.11 FABRICATING REINFORCEMENT

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.12 CONCRETE MIXING

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

PART 3 - EXECUTION

3.1 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.

3.2 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 and seal with manufacturer's recommended tape.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.

- C. Contraction Joints in Slabs-on-Grade: See Structural Drawing General Notes Sheets S-001 and S-002.

- D. Isolation Joints in Slabs on Grade:

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.5 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. 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.
- D. 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.

3.6 FINISHING FORMED SURFACES

- A. **Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete at all exterior exposed concrete wall surface unless noted otherwise:**
1. **Grout-Cleaned Finish (Sack and Patch): Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. Exception: Tie holes, or faux tie holes, are to remain visible. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.**
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, 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 in one direction.
1. Apply scratch finish to surfaces 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 restraighening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen 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 exposed to view or to be covered with resilient flooring, carpet, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface.
 3. Finish and measure surface, so gap at any point between concrete surface and an unveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/4 inch**.
- 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.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread **25 lb/100 sq. ft.** of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 2. After broadcasting and tamping, apply float finish.
 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.8 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. 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.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. 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.

3.9 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 for hot-weather protection during curing.

3.10 LIQUID FLOOR TREATMENT APPLICATION

- A. Provide Penetrating Liquid Floor Treatment complying with Section 033543 "Polished Concrete finishing."

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections: See Structural Drawing General Notes Sheets S-001 and S-002.
- C. Concrete Tests: See Structural Drawing General Notes Sheets S-001 and S-002.

END OF SECTION 03 3000

SECTION 04 2200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Miscellaneous masonry accessories.

B. Related Requirements:

1. Structural Drawing General Notes Sheets S-001 and S-002.

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. Shop Drawings: For the following:

1. See Structural Drawing General Notes Sheets S-001 and S-002.

- C. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include data on material properties.

- B. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.6 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: See Structural Drawing General Notes Sheets S-001 and S-002.

2.3 CONCRETE MASONRY UNITS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less-than-nominal dimensions.
 - 1. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.4 MORTAR AND GROUT MATERIALS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.5 REINFORCEMENT

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.6 TIES AND ANCHORS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Preformed Control-Joint Gaskets: Made from **styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406** and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.8 MORTAR AND GROUT MIXES

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer

2.9 INTEGRAL WATER REPELLENT

- A. Water Repellent: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify that foundations are within tolerances specified.
 2. Verify that reinforcing dowels are properly placed.
 3. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **running bond** do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.5 MORTAR BEDDING AND JOINTING

- A. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Wet joint surfaces thoroughly before applying mortar.

- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- D. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. See Structural Drawing General Notes Sheets S-001 and S-002:

3.8 CONTROL AND EXPANSION JOINTS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

3.9 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape **as recommended by flashing manufacturer**.
 - 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 3. Install metal **drip edges** with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: See Structural Drawing General Notes Sheets S-001 and S-002.

C. Testing: See Structural Drawing General Notes Sheets S-001 and S-002.

END OF SECTION 04 2200

SECTION 04 2613 - MASONRY VENEER

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. Clay face brick.
- 2. Pre-Cast Concrete Sills
- 3. Mortar.
- 4. Ties and anchors.
- 5. Embedded flashing.
- 6. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

- 1. Steel lintels in masonry veneer.
- 2. Steel shelf angles for supporting masonry veneer.

C. Related Requirements:

- 1. Section 05 1200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
- 2. Section 07 6200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For the following:

- 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- 2. Pre-Cast Concrete Sills
- 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

- C. Samples for Initial Selection:

- 1. Mortar.

2. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Clay face brick, **in the form of straps of five or more bricks.**
2. Pre-Cast Concrete Sills
3. Weep holes and vents.
4. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include data on material properties.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C 67 and a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
2. Mortar admixtures.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. **Build mockup of typical exterior brick wall.**
 2. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in mockup.
 - b. **Include upper and lower corners of window opening, including concrete sill.** Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include metal studs, sheathing, water-resistive barrier, insulation, air barrier, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
 3. Clean exposed faces of mockups with masonry cleaner as indicated.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.3 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C 216.
 - 1. Manufacturer: Basis of Design is Mutual Materials.
 - 2. Product: Clay Face Brick
 - 3. Grade: SW.
 - 4. Type: FBX.
 - 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
 - 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
 - 8. Size (Actual Dimensions): 3-1/2 inches wide by 2-1/2 inches high by 7-1/2 inches long.
 - 9. Application: Use where brick is exposed unless otherwise indicated.
 - 10. Color and Texture: Custom blend of 25% each of:
 - a. Columbia Red
 - b. Ruby
 - c. Vintage
 - d. Inca- Mission

2.4 PRE-CAST CONCRETE SILLS

- A. Meet material requirements of 03 3000. Color
- B. Color and finish to match exposed concrete foundation walls.

2.5 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
- E. Mortar Cement: ASTM C 1329/C 1329M.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- G. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- J. Water: Potable.

2.6 TIES AND ANCHORS

- 1. **Per Structural Notes on S-001 and S-002.**

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with **Section 07 6200 "Sheet Metal Flashing and Trim"**.
- B. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to receive counterflashing, use metal flashing.

2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
 4. Where flashing is fully concealed, use metal flashing or flexible flashing.
- C. Solder and Sealants for Sheet Metal Flashings: **As specified in Section 07 6200 “Sheet Metal Flashing and Trim.”**
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer’s standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- E. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Aluminum Weep Hole/Vent: Units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel, with louvers stamped in web and with a top flap to keep mortar out of the head joint; factory primed and painted before installation to comply with Section 09 9113 “Exterior Painting” in color selected by Architect.
 2. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

2.9 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer’s standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.10 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use: **Products recommended by brick manufacturer.**

3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, **Property** Specification. Use Type N unless another type is indicated.
 1. For masonry below grade or in contact with earth, use **Type M**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. **Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.**
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **running bond**; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Lay **hollow brick** with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 - 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- C. Set pre-cast concrete sills trim units in full bed of mortar with full vertical joints.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
 - 4. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 - 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to **wall framing** with **seismic** masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten **screw-attached and seismic** anchors **through sheathing to wall framing** with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed **tie sections** in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each **2.67 sq. ft.** of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide not less than **1 inch** of airspace between back of masonry veneer and face of **insulation**.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than **1/2 inch** wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than **1/2 inch** for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than **3/8 inch**.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. **Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where recommended by manufacturer.**
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 - 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 - 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use **specified weep/vent products** to form weep holes.

2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes 24 inches o.c. unless otherwise indicated.
 4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
 5. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use **specified weep/vent products** to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for **mortar air content and compressive strength**.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent

construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean stone trim to comply with stone supplier's written instructions.
 - 8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2613

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:

1. Section 05 3100 "Steel Decking" for field installation of shear connectors through deck.
2. Section 09 9113 "Exterior Painting", Section 09 9123 "Interior Painting" and 09 9600 "High Performance Coatings".

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: See Structural Drawing General Notes Sheets S-001 and S-002.

1.4 INFORMATIONAL SUBMITTALS

- A. See Structural Drawing General Notes Sheets S-001 and S-002
- B. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.2 STRUCTURAL-STEEL MATERIALS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.4 PRIMER

- A. Primer: Comply with Section 09 9113 "Exterior Painting", Section 09 9123 "Interior Painting" and 09 9600 "High Performance Coatings".

2.5 GROUT

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.6 FABRICATION

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces to be field welded.
 2. Surfaces of high-strength bolted, slip-critical connections.

- 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- C. 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.

3.4 FIELD CONNECTIONS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: : Owner will engage special inspectors to perform tests and inspections and prepare reports:
 - 1. Testing: See Structural Drawing General Notes Sheets S-001 and S-002
 - 2. Inspections: See Structural Drawing General Notes Sheets S-001 and S-002

END OF SECTION 05 1200

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH- and DLH-series long-span steel joists.
5. Joist accessories.

B. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for field-welded shear connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. See Structural Drawing General Notes Sheets S-001 and S-002.

Qualification Data: For manufacturer:

C. Manufacturer certificates.

D. Welding certificates.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications"

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: See Structural Drawing General Notes Sheets S-001 and S-002.

2.3 PRIMERS

- A. Primer: Provide shop primer that complies with Section 099123 "Interior Painting" and 09 9600 "High Performance Coatings".

2.4 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **Owner will engage** a qualified testing agency to perform tests and inspections.

END OF SECTION 05 2100

SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 05 1200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 05 5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
4. Section 09 9123 "Interior Painting" and 09 9600 "High Performance Coatings" for repair painting of primed deck and finish painting of deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. See Structural Drawing General Notes Sheets S-001 and S-002.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

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. See Structural Drawing General Notes Sheets S-001 and S-002.."

2.2 ROOF DECK

- A. See Structural Drawing General Notes Sheets S-001 and S-002:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), see structural drawings for minimum structural properties, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: **Manufacturer's standard.**

2.3 COMPOSITE FLOOR DECK

- A. See Structural Drawing General Notes Sheets S-001 and S-002:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard baked-on, rust-inhibitive primer. See structural drawing for minimum structural properties,

2.4 ACCESSORIES

- A. General: See Structural Drawing General Notes Sheets S-001 and S-002.

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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

3.3 ROOF-DECK INSTALLATION

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 05 3100

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Soffit framing.
- B. Related Requirements:
 - 1. Section 09 2216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. See Structural Drawing General Notes Sheets S-001 and S-002.

1.4 INFORMATIONAL SUBMITTALS

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.4 SOFFIT FRAMING

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

2.5 FABRICATION

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. See Structural Drawing General Notes Sheets S-001 and S-002.

- B. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- C. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. See Structural Drawing General Notes Sheets S-001 and S-002.
- B. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing agency will report test results promptly and in writing to Contractor and Architect.

3.6 REPAIRS AND PROTECTION

END OF SECTION 05 4000

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Elevator machine hoist beams.
5. Steel shapes for supporting elevator door sills.
6. Metal ladders.
7. Elevator pit sump covers.
8. Metal bollards.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 05 1200 "Structural Steel Framing."
3. Section 09 9600 "High Performance Coatings"

1.2 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 metal fabrications that are anchored to or that receive other work. 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.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 1. Steel framing and supports for countertops.
 2. Steel tube reinforcement for low partitions.
 3. Steel framing and supports for mechanical and electrical equipment.
 4. Elevator machine, hoist beams.
 5. Steel shapes for supporting elevator door sills.
 6. Metal ladders.
 7. Elevator pit sump covers.

8. Metal bollards.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Aluminum Ladders: Aluminum ladders, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 1. Size of Channels: 1-5/8 by 1-5/8 inches
 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M; **coated with rust-inhibitive, baked-on, acrylic enamel.**
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- F. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- H. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- I. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Anchors, General: 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 E 488/E 488M, conducted by a qualified independent testing agency.
- C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; 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, all hot-dip galvanized per ASTM F 2329.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting" and 09 9600 "High Performance Coatings".
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. 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.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by

partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Aluminum Ladders:

1. Basis for design: Precision Ladders, Morristown, TN. (800) 225-7814
2. Space siderails **26 inches** apart unless otherwise indicated.
3. Siderails: Continuous, **1-by-3-inch-by-1/8-inch** tubular rails.
4. Rungs: **Continuous, 1-by-3-inch-by-1/8-inch** tubular rails.
5. Pre-fabricated rungs attach in centerline of siderails. fastening by welding or with stainless-steel fasteners or brackets and aluminum rivets.
6. Support each ladder **at top and bottom and not more than 60 inches o.c.** with welded or bolted steel brackets.

2.8 METAL BOLLARDS

A. In-Place Bollards

1. Fabricate metal bollards from Schedule 40 steel pipe.
2. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
3. Fabricate internal sleeves for removable bollards from Schedule 40 steel with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
4. Prime bollards with zinc-rich primer.

B. Removable Bollards

1. **Basis of Design: TrafficGuard Inc**
 - a. **Product: RFP3548R**
2. **Finish: Paint per plans and Section 09 9600 "High Performance Coatings"**

2.9 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

- A. 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.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items unless they are to be embedded in concrete, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 099113 "Exterior Painting", Section 099123 "Interior Painting", and 09 9600 "High Performance Coatings".
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.11 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

2.12 ELEVATOR PIT SUMP COVERS

- A. Fabricate from galvanized grate or 1/8-inch rolled-steel floor plate with four 1-inch- diameter holes for water drainage and for lifting.
- B. Provide steel angle supports as needed.

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.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

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 ceiling hung toilet partitions, operable partitions and overhead doors and securely to, and rigidly brace from, building structure.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 6 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

- C. Anchor internal sleeves for removable bollards in concrete by inserting in pipe sleeves preset into concrete. Fill annular space around internal sleeves solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.
- D. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- E. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.
- F. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- B. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting", Section 099123 "Interior Painting", and 09 9600 "High Performance Coatings".
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 5000

SECTION 05 5113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with **concrete-filled and abrasive-coating-finished, formed-metal** treads.
2. **Steel tube** railings attached to metal stairs.
3. **Steel tube** handrails attached to walls adjacent to metal stairs.
4. Abrasive Nosings

1.2 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For stairs **and railings**, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design stairs **and railings**.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: 100 lbf/sq. ft..
 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
- b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. Component Importance Factor: 1.5.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: **ASTM A 500 (cold formed) or ASTM A 513**.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30, unless another grade is required by design loads.
- F. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.3 ABRASIVE NOSINGS

- A. Extruded Units: Aluminum units with abrasive filler in an epoxy-resin binder.
 - 1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
- B. **Type: Two part system. Install sub channel at initial stair construction. Install slip resistant strip just prior to substantial completion.**
- C. Provide anchors for embedding units in concrete, either integral or applied to units.
- D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.
- E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

- A. Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with **Section 09 9600 "High-Performance Coatings."**
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
- E. Welded Wire Reinforcement: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.6 PRECAST CONCRETE TREADS

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi and a total air content of not less than 4 percent or more than 6 percent.
- B. Reinforcement: Galvanized, welded wire reinforcement, 2 by 2 inches by 0.062-inch- diameter wire; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

2.7 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, **railings**, 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. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. 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 **Type 3 welds: partially dressed weld with spatter removed.**
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

2.8 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," **Commercial** Class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers of steel per Structural plans.
 - a. Provide closures for exposed ends of channel stringers.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness **needed to comply with performance requirements, but not less than 0.067 inch.**
- D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness **needed to comply with performance requirements, but not less than 0.097 inch.**

2.9 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: Per plans.
 2. Picket Infill: Per plans.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **Type 1 welds: no evidence of a welded joint** as shown in NAAMM AMP 521.
 - C. Form changes in direction of railings **by inserting prefabricated elbow fittings**.
 - D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 - E. Close exposed ends of railing members with prefabricated end fittings.
 - F. Provide wall returns at ends of wall-mounted handrails.
 - G. Connect posts to stair framing by direct welding.
 - H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses.
- 2.10 FINISHES
- A. Finish metal stairs after assembly.
 - B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
 - C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. 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.
- B. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints.

- D. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- E. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete.
- F. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by **welding** to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 05 5113

SECTION 05 5200 ILLUMINATED RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel pipe handrails and railings.
2. Railing and handrail components.

B. Related Requirements:

1. Section 26 5000 - Lighting

1.2 REFERENCES

A. Reference Standards: Current edition at date of Bid.

B. Architectural Manufacturer's Association: AMA 611 - Voluntary Standards for Anodized Architectural Aluminum

C. American National Standards Institute (ANSI): ICC/ANSI A117.1 - Accessible and Useable Building Facilities.

D. ASTM International (ASTM):

1. ASTM A36 - Specification for Carbon Structural Steel
2. ASTM A53 - Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
3. ASTM A123 - Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes
6. ASTM A307 - Specification for Carbon Steel Externally threaded Standard Fasteners.
7. ASTM A312 - Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
8. ASTM B 24 - Specifications for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
9. ASTM B483 - Specifications for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Application
10. ASTM C827 - Test Method for Early Volume Change of Cementitious Mixtures.
11. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

E. National Ornamental & Miscellaneous Metal Association (NOMMA) (Web Site <http://www.nomma.org> : NOMMA Guideline 1: Joint Finishes.F. SSPC, The Society For Protective Coatings - Volume 1, Good Painting Practice, and Volume 2, Systems and Specifications. Editions current as of date of Project Manual, Web Site <http://www.sspc.org> .

1. SSPC-SP-1: Surface Preparation Specification No. 1, Solvent Cleaning.
2. SSPC-SP-2: Surface Preparation Specification No. 2, Hand Tool Cleaning.

3. SSPC-SP-3: Surface Preparation Specification No. 3, Power Tool Cleaning.
4. SSPC-SP-6: Surface Preparation Specification No. 6, Commercial Blast Cleaning.
5. SSPC-SP-10: Surface Preparation Specification No. 10, Near White Blast Cleaning.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Shop Drawings: Plans, elevations, and fabrication details showing configurations, dimensions, gauges, finishes, and joining methods including weldments, anchorages, and attachments. Provide wiring diagrams and rough-in details for illuminated handrails.
- C. Product Data: Railing components showing conformance to specified requirements.
- D. Samples: For all finishes and textures
- E. Certificate: State that specified shop finish procedures, methods, and products have been followed.

1.4 QUALITY ASSURANCE

- A. Supply setting templates for items cast into concrete and embedded in masonry.
- B. Fabricator and Installer: Company specializing in work of this Section with minimum 5 years documented experience performing commercial quality work of comparable scope of illuminated railings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack components to prevent bending, twisting, scratching of finished surfaces and other damage during shipment.
- B. Store inside building or in protected area on blocks away from dirt and moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: The Wagner Companies; P.O. Box 423; Butler, WI 53007. Phone: 888-243-6914. Fax: 414-214-0550. Web site: www.wagnercompanies.com. E-mail: info@mailwagner.com.

2.2 REGULATORY REQUIREMENTS

- A. Handrails: Conform to IBC Section 1012.
- B. Railing and Guardrails Lateral Loads: Conform to IBC Section 1607, including 1607.7.1 and subsections for lateral loads.
- C. Welding: Perform in accordance with referenced regulatory agencies and Section 050560.

2.3 PERFORMANCE / DESIGN CRITERIA

- A. Railing Assembly, Wall Rails, and Attachments: Where not otherwise specified or shown on Drawings, assume provisions of ASTM E985, except where IBC provisions are more stringent.
- B. Deflection Criteria: Conform to ASTM E985.

2.4 RAILING MATERIALS

- A. Stainless Steel Pipe: ASTM A312, Grade TP304 (Type 304), Schedule 40, 1-1/2 inch (1.900 inch outside diameter) or 1-1/4 inch (1.660 inch outside diameter).

- B. Stainless Steel Plate and Flat Bar Railing Posts and Sections: ASTM A276, Type 304, cold formed, thickness and fabricated as detailed on Drawings.

2.5 HANDRAIL BRACKETS

- A. Stainless Steel Wall Brackets for Stainless Steel Pipe: Stamp formed 3/16 inch stainless steel, 3 inch centerline of railing to wall, one 7/16 inch diameter fastener hole, round top suitable for joining pipe rail, able to accept welded or machine screw connection.
 - 1. R&B Wagner, Model LU206

2.6 PIPE AND TUBE HANDRAIL AND RAILING SYSTEM COMPONENTS

- A. Inside Radius Ells: Seamless steel with radius ell wall return fittings at railing ends and railing corners.
- B. Flanges: Type 304 Stainless Steel, 1/8" thick
- C. Stainless Steel Ball End Caps for Stainless Steel Pipe Railings: Weld-On, round tube end, connector, 1-1/2 inch diameter with 1-1/8 inch head height, except as otherwise as required for pipe diameter.
 - 1. R&B Wagner, Type C, 3260
- D. Stainless Steel Flat End Caps for Stainless Steel Pipe Railings: Weld-On, round tube end, connector, 1-1/2 inch diameter with 1-1/8 inch head height, except as otherwise as required for pipe diameter.
 - 1. R&B Wagner, Type D, 3269
- E. Connectors: Coped, drive-on type, welded.
- F. Wedge-lock Welding Connectors: Types to suit conditions and as recommended by manufacturer.
- G. Other Components: Fabricate of steel to match pipe material, including railings, inserts, and sleeves as necessary to suit installation.
- H. Handrail Lighting: See Electrical Plans and 26 5000 Lighting

2.7 ACCESSORIES

- A. Expandable Grout for Pipe Rails: Conforming to ASTM C827 and as specified by Section 033000.
- B. Fasteners and Anchors: Stainless steel designed for intended use and function, and as instructed by manufacturer.
 - 1. Concrete: Expansion shield and hex head lag bolt, removable, Powers Fasteners, Power-Bolt, specified for type and quality.
 - 2. Steel Stud and Backing: Hex head, self-drilling, self-tapping screws, 12-14 screw thread, Powers Twin-Fast, specified for type and quality.
 - 3. Masonry: Epoxy adhesive anchor system, Hilti, HIT HY-20 and Powers Fasteners, Power-Fast, specified for type and quality.
- C. Connections: Weld steel to steel, including railing and bracket connections, unless otherwise indicated.
- D. Auto-Body Joint Fillers: Bondo, or other accepted auto-body filler as needed to make welded and other permanent connections smooth and uniform after grinding smooth for materials to be primed and painted.
- E. Miscellaneous Items: Provide all other steel and iron items indicated or required to complete the work.

2.8 FABRICATION

- A. Fit and shop assemble components in largest practical size for delivery to site.
- B. Provide anchors, plates, and other components needed to make secure, structural connections.

- C. Provide spigots, sleeves and other components to accommodate site assembly and installation.
- D. Fabricate components of same material and finish as fabrications, except where otherwise specified. Fit with matching pipe fittings, pipe ells, end plugs, and radiused returns.
- E. Construct welded structural steel assemblies:
 - 1. Conform to NOMMA, Guideline 1: Joint Finishes, Finish No. 2.
 - 2. Continuously seal joined pieces by continuous welds or intermittent welds and filler.
 - 3. Grind exposed joints flush and smooth with adjacent finish surfaces.
 - 4. Butt-weld pipe members together. For long runs (40 feet maximum), fabricate with smaller diameter slip joint inserts, to accommodate movement.
- F. Make exposed joints butt tight, flush and hairline.
- G. Ease exposed edges with small uniform radius.
- H. Drill and tap holes before applying shop primer coating. Countersink and drill at unobtrusive locations.

2.9 FINISHES

- A. Interior & Exterior: Stainless Steel Pipe: No. 4 Satin finish.
- B. Bolts and Other Threaded Fasteners at Assemblies: Stainless Steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions ready to receive work of this Section.

3.2 PREPARATION

- A. Protect surrounding areas and surfaces to preclude damage during work of this Section.
- B. Supply items required to be cast into concrete, embedded in masonry, and placed in partitions with setting templates, to appropriate Section.
- C. Separate dissimilar metals using isolation tape or coatings acceptable to Architect. Do not use bituminous coatings.
- D. Protect metal surfaces where contacting cured concrete and other cementitious materials.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Include accessory items indicated or as required to complete work of this Sections.
- C. Erect assemblies plumb, true to line, and secure. Use specified expandable grout. Perform welding where applicable.
- D. Separate dissimilar metals using isolation tape or coatings acceptable to Architect. Do not use bituminous coatings.
- E. Leave assemblies securely anchored, rigid, and free from defects.

3.4 PROTECTION

- A. Protect railing system and finish from damage during construction.

3.5 CLEANING

- A. Following installation, clean steel.
- B. Leave installation area clean and free from debris resulting from work of this Section.

END OF SECTION 05 5200

SECTION 05 7300 - DECORATIVE METAL RAILINGS

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. Steel and iron decorative railings.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

- 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.
- B. Coordinate installation of anchorages for railings. 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 items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.6 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.

- B. Shop Drawings: Include plans, elevations, sections, and attachment details.
 - 1. For illuminated railings, include wiring diagrams and roughing-in details.
- C. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Welded connections.
 - 4. Brazed connections.
 - 5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- D. Delegated-Design Submittal: **CONTRACTOR IS RESPONSIBLE FOR STRUCTURAL ENGINEERING OF RAILINGS.** For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **professional engineer**.
- B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- E. Preconstruction test reports.
- F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.8 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups as shown on Drawings.
 - 2. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Section 016000 "Product Requirements."
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:

- a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
 3. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
 4. Provide extruded-metal brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

2.4 STEEL AND IRON

- A. Tubing: **ASTM A 500/A 500M (cold formed)**.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.

2. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 3. Dissimilar Metals: **Type 304** stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated **and capable of withstanding design loads**.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless **otherwise indicated**.
1. Provide **Phillips** flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **Group 1** stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with **Section 09 9600 "High-Performance Coatings."**
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: **Cementitious galvanized metal primer complying with MPI#26.**

- H. Intermediate Coats and Topcoats: Provide products that comply with **Section 09 9600 "High-Performance Coatings."**
- I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- J. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: **At exterior locations** provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, **but not less than that required to support structural loads.**
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
- D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- E. Form work true to line and level with accurate angles and surfaces.
- F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- H. Connections: Fabricate railings with **welded** connections unless otherwise indicated.
- I. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.
 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.
- J. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- K. Form changes in direction as follows:
1. Welding separate pieces together.
- L. Close exposed ends of hollow railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide **stainless-steel** sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.
- D. Dull Satin Finish: No. 6.
- E. Satin, Reflective, Directional Polish: No. 7.
- F. Mirrorlike Reflective, Nondirectional Polish: No. 8.
- G. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- H. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.

2.10 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize **exterior** steel and iron railings, including hardware, after fabrication.
 - 2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - 3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - 5. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 6. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, but galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with **primers specified in Section 09 9600 "High-Performance Coatings"**.
 2. Do not apply primer to galvanized surfaces.
- G. Shop-Painted Finish: Comply with **Section 09 9600 "High-Performance Coatings."**
1. **Color: Match PT-9.**
- H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
1. **Color: Match PT-9.**
- I. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
 4. **Color: Match PT-9.**
- J. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
 4. **Color: Match PT-9**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with **nonshrink, nonmetallic grout**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **nonshrink, nonmetallic grout**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, **welded to post after placing anchoring material**.
- D. Leave anchorage joint exposed with **1/8-inch buildup, sloped away from post**.

- E. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
 - 2. For copper-alloy railings, attach posts as indicated using fittings designed and engineered for this purpose.
 - 3. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
 - 4. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with **sleeves concealed within brackets on underside of rails connected to** railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and **welded to railing ends**.
- C. Attach handrails to walls with wall brackets **except where end flanges are used**. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with **flange tapped for concealed anchorage to threaded hanger bolt**.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into **fire-retardant-treated** wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
 - 6. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 INSTALLING PLASTIC HANDRAIL CAPS

- A. Apply plastic handrail caps to top rails and handrails, where indicated, complying with manufacturer's written instructions for cutting, mounting, forming, welding, cleaning, applying end caps, and finishing.
- B. Minimize number of joints in plastic caps by installing in lengths as long as possible. Allow for shortening of plastic cap caused by welding and splicing process; butt ends together to produce hairline joint.
 - 1. Continuously weld, splice, miter, and end-cap joints using cap manufacturer's electric welding iron designed for this purpose. Remove welding flash while material is still soft.
 - 2. Weld only prongs on underside of plastic cap at splice, miter, and end-cap joints. After cutting plastic cap, dress ends with file to produce a hairline fit between abutting sections. After mounting cap, polish top surface with cap manufacturer's solvent designed for this purpose until joint becomes almost invisible.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made **by Owner**.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING

- A. Clean surfaces by wiping with a damp cloth and then wiping dry.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in **Section 09 9600 "High-Performance Coatings."**
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

3.9 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 7300

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 CODE

- A. All wood products used in Type II Construction must meet the requirements set forth in IBC, specifically 603 and 805.

1.2 SUMMARY

- A. See structural drawings for information on structural components.
- B. Section Includes:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking, cants, and nailers.
 - 3. Plywood backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
 - 1. Product Data for adhesives, including printed statement of VOC content.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.
 - 5. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Refer to structural drawings and notes (if provided) for product information and requirements. Drawings govern over requirements stated herein. In all cases, provide products in compliance with all applicable codes and AHJ.
 - 1. Contractor shall notify Architect of conflicts and receive clarification prior to proceeding.
 - 2. Where drawings are non-specific as to which connection accessory to use, the Contractor is responsible for selecting the appropriate connectors from the manufacturers chosen. Connection shall support the loads indicated, or if not indicated then provide connection capable of supporting the full capacity of the member being supported. Provide all connection hardware and accessories required by the design, whether specifically called out or not.
- B. 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 or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- C. 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.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 **for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.**
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. **Do not use inorganic boron (SBX) for sill plates.**
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat **items indicated on Drawings, and the following:**
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, **furring, stripping** and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

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.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.
- C. Concealed Boards: 15 percent maximum moisture content and 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 WWP.

2.4 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 A 153/A 153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on **ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308** as appropriate for the substrate.

2.5 METAL FRAMING ANCHORS

- A. Available Manufacturers: Subject to compliance with requirements, any manufacturers offering products that may be incorporated into the Work.

- B. Allowable design loads, 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; 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 (Z550) coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, **fire-retardant treated** in thickness indicated or, if not indicated, not less than **1/2-inch** nominal thickness.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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.
- B. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- C. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.

- D. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- E. 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 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 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 06 1000

SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Subflooring.
3. Sheathing joint and penetration treatment.

B. Related Requirements:

1. **Section 06 1000 "Rough Carpentry".**
2. **Section 07 2500 "Water Barriers"** for water-resistive barrier/air barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.3 WARRANTY

- A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Manufactures:
 - a. Georgia-Pacific Gypsum LLC
 - b. Certainteed Corporation
 - c. National Gypsum
 - d. USG Corporation
 - 2. Type and Thickness: **Regular, 1/2 inch, Type X, 5/8 inch** thick for fire rated locations.
 - 3. Size: **48 by 96 inches** or **48 by 120 inches** for vertical installation.
 - 4. Width: 4 feet.
 - 5. Weight: 1.9 lb/sq. ft.
 - 6. Edges: Square.
 - 7. Surfacing: Fiberglass mat on face, back, and long edges.
 - 8. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540
 - 9. pounds per square foot, dry.
 - 10. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
 - 11. Humidified Deflection (ASTM C1177): Not more than 2/8 inch.
 - 12. Permeance (ASTM E96): Not less than 23 perms.
 - 13. R-Value (ASTM C518): 0.56.
 - 14. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
 - 15. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth

2.3 FASTENERS

- A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. See Structural plans for requirements.
- B. General: Where fire-retardant-treated materials are indicated, use materials complying 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.
- C. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.
- D. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- E. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- F. Application: **Treat all plywood unless otherwise indicated.**
 - 1. Subflooring and underlayment for raised platforms. See Structural plans.

2.5 SUBFLOORING AND UNDERLAYMENT

- A. See Structural plans for requirements.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for **Glass-Mat** Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 2. ICC-ES evaluation report for fastener.
- D. Coordinate **wall and roof** sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

- D. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 1600

SECTION 06 2023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Interior trim
2. Exposed Lumber Framing.
3. Interior stairs.

- B. Related Requirements:

1. Section 09 9123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

- B. **Shop Drawings: Show proposed layout of joints for all installations.**

- C. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.
- B. Sample Warranty: For manufacturer's warranty.
- C. Woodwork Quality Standard Compliance Certificates: **AWI Quality Certification Program certificates** or **WI Certified Compliance Program certificates**.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: **Certified participant in AWI's Quality Certification Program** or **Licensee of WI's Certified Compliance Program**.
- B. Installer Qualifications: **Certified participant in AWI's Quality Certification Program** or **Licensee of WI's Certified Compliance Program**.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) indicated for construction, finishes, installation, and other requirements.
 - 1. **Provide labels and certificates from AWI or WI certification program indicating that paneling, including installation, complies with requirements of grades specified.**
- B. 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 American Lumber Standard Committee's Board of Review. Grade lumber by an agency certified by the American Lumber Standard Committee's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- C. Softwood Plywood: DOC PS 1.
- D. Hardboard: ANSI A135.4.

2.2 INTERIOR TRIM

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish): **WD-1**
 - 1. Species and Grade: Red oak, Clear; NHLA.
 - 2. Maximum Moisture Content: 9 percent.
 - 3. Finger Jointing: Not allowed.
 - 4. Gluing for Width: Not allowed.
 - 5. Veneered Material: Not allowed.
 - 6. Face Surface: Surfaced (smooth).
 - 7. Matching: Selected for compatible grain and color.
 - 8. Tongue and Groove
- B. Lumber Trim for Opaque Finish (Painted Finish): **WD-3**
 - 1. Species and Grade: Softwood, Paint grade.
 - 2. Maximum Moisture Content: 15 percent.
 - 3. Maximum Moisture Content: 13
 - 4. Finger Jointing: Not allowed.
 - 5. Face Surface: Surfaced (smooth).

2.3 EXPOSED LUMBER FRAMING: **WD-2**

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: White maple, Clear; NHLA.
2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Not allowed
5. Veneered Material: Not allowed
6. Face Surface: Surfaced (smooth)
7. Matching: Selected for compatible grain and color.

2.4 STAIRS AND RAILINGS

A. Treads: **WD-4 & WD-5**

1. Species and Grade: Red oak, Clear; NHLA.
2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Not allowed.
5. Veneered Material: Not allowed.
6. Face Surface: Surfaced (smooth).
7. Length: Treads to be full width. Landing is allowed to have joints that are staggered from adjacent boards.
8. Finish: Clear, protective coating for high traffic walkway.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.6 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 1. Interior standing and running trim, except shoe and crown molds.
 2. Wood-board paneling.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at

outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum-board joint finishing operations are completed.
3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 STAIR AND RAILING INSTALLATION

- A. Treads at Interior Stairs: Secure treads using lag bolts installed from the underside of treads or dowels in concrete. Fasteners to not be visible from topside. Also adhere treads to substrate.

3.6 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 2023

SECTION 06 4116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
2. Plastic-laminate-faced architectural countertops.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
4. Cabinet Pulls

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for **electrical switches and outlets and other items** installed in architectural plastic-laminate cabinets.
4. **Show locations of joints in plastic laminate and solid surface finishes.**

- C. Samples for Verification:

1. Plastic laminates, **8 by 10 inches** color, pattern, and surface finish, **with one sample applied to core material and specified edge material applied to one edge.**
2. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
3. Exposed cabinet hardware and accessories, one unit for each type.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **Installer & fabricator.**
- B. Product Certificates: For **each type of product**
- C. Woodwork Quality Standard Compliance Certificates: **AWI Quality Certification Program certificates.**
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that 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. **Shop is a certified participant in AWI's Quality Certification Program or with a minimum of 5 years' of documented experience fabricating cabinets and countertops of this nature.**
- B. Installer Qualifications: **Certified participant in AWI's Quality Certification Program or with a minimum of 5 years' of documented experience fabricating cabinets and countertops of this nature.**
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

1.10 WARRANTY

- A. Installer shall warranty work for installation of materials and products specified in this section for a period of one year to commence with Physical Completion as established by the Architect and as described in Section 01 7800 "Warranties".

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide **labels and certificates** from **AWI** certification program indicating that woodwork, **including installation**, complies with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

- B. Grade: **Premium.**
- C. Type of Construction: **Frameless.**
- D. Cabinet, Door, and Drawer Front Interface Style: **Flush overlay.**
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Pattern Direction: To be coordinated with Architect.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, of matching Grade.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Colors, Patterns, and Finishes: As indicated on drawings.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. 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.**
- L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Match Architect's sample.

2.2 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
 - 1. Provide **labels and certificates** from **AWI, WI** certification program indicating that countertops, **including installation**, comply with requirements of grades specified.

2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: **Premium**.
- C. High-Pressure Decorative Laminate: NEMA LD 3.
- D. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:
1. Laminate has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.9.5:
 - a. Nitric Acid (30 Percent): Moderate effect.
 - b. Sulfuric Acid (77 Percent): Moderate effect.
 - c. Hydrochloric Acid (37 Percent): Moderate effect.
 - d. Phosphoric Acid (75 Percent): No effect.
 - e. Acetic Acid (98 Percent): No effect.
 - f. Formaldehyde: No effect.
 - g. Ethyl Acetate: No effect.
 - h. Ethyl Ether: No effect.
 - i. Phenol (85 Percent): Moderate effect.
 - j. Benzene: No effect.
 - k. Xylene: No effect.
 - l. Butyl Alcohol: No effect.
 - m. Furfural: No effect.
 - n. Methyl Ethyl Ketone: No effect.
 - o. Sodium Hydroxide (25 Percent): No effect.
 - p. Sodium Sulfide (15 Percent): No effect.
 - q. Ammonium Hydroxide (28 Percent): No effect.
 - r. Zinc Chloride: No effect.
 - s. Gentian Violet: No effect.
 - t. Methyl Red: No effect.
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Match Architect's sample.
 2. Grain Direction: Parallel to cabinet fronts.
- F. Edge Treatment: 90 degree edges. Finish the same as laminate cladding on horizontal surfaces.
- G. Core Material: Particleboard or medium-density fiberboard
- H. Core Thickness: **3/4 inch**
1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

- I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.
- J. Paper Backing: Provide paper backing on underside of countertop substrate.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: **5 to 10** percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 110 degrees of opening. **Self, soft closing.**
- C. **Pulls: Mockett DP128/6**
 - 1. **Size: 6-11/16"**
 - 2. **Finish: Satin Stainless Steel**
- D. Catches: Magnetic catches, BHMA A156.9, B03141, Push-in magnetic catches, BHMA A156.9, B03131, Roller catches, BHMA A156.9, B03071, or Ball friction catches, BHMA A156.9, B03013.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081. Shelf Rests: 32mm boring system with 5mm metal spoon clips.
- F. Drawer Slides: **Self, soft closing**, side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following minimum loads:
 - 1. Box Drawer Slides: 75 lbf.
 - 2. File Drawer Slides: 150 lbf.
- G. Door Locks: BHMA A156.11, E07121.

- H. Drawer Locks: BHMA A156.11, E07041.
- I. Door and Drawer Silencers: BHMA A156.16, L03011.
- J. Casters for Podium: Heavy duty non-marring swivel casters shall have ball bearing swivels, 4 bolt mounting and tread braking. Mobile cabinets shall have 4" high casters (rated 300# each): (2) swivel braking and (2) swivel non-braking type. Casters shall be integral bolted onto steel channel cabinet member. 14-gauge formed channel member shall be 3 3/4" wide with 3/4" downturned legs each with double thick hem edge. Steel frame member shall have bolt attachment to unit bottom and also cross bolted into barrel style fastening system in cabinet ends.
- K. Outlet Boxes
 - 1. For Podium Top:
 - a. Style: Recessed with closeable cover.
 - b. Color: Cream
 - c. Connections: Coordinate with AV installer, but at a minimum provide:
 - 1) (2) 120V power outlets
 - 2) (1) HMDI
 - 3) (1) C Port
 - 4) (1) CAT 6
 - 5) (1) USB
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- N. Grommets for Cable Passage through Countertops: 2-inch, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Color: match countertop/cabinet color. Architect to select from manufacturer's full range.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, or Fire-retardant-treated softwood lumber as required by code, 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, Contact cement, PVA, Urea formaldehyde or Resorcinol.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 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 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly 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.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-inch penetration into wood framing, blocking, or hanging strips.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Secure backsplashes **to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.**
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 4116

SECTION 07 1113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, emulsified-asphalt dampproofing.
- B. Related Requirements:
 - 1. Section 03 3000 "Cast-in-Place Concrete" for bituminous vapor retarders.
 - 2. Section 07 1326 "Self-Adhering Sheet Waterproofing"

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- 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. APOC, Inc
 - 2. BASF
 - 3. Euclid Chemical Company
 - 4. Brewer Company

5. ChemMasters, Inc
6. Henry Company
7. Karnak Corp.
8. Mar-flex Waterproofing and Building Products
9. W.R. Meadows, Inc

B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Patching Compound: Type recommended in writing by dampproofing manufacturer.

2.4 MOLDED-SHEET DRAINAGE PANELS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 1. Test for surface moisture according to ASTM D 4263.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or one fibered brush or spray coat at not less than 3 gal./100 sq. ft..
- B. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft.

END OF SECTION 07 1113

SECTION 07 1326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Modified bituminous sheet waterproofing, fabric reinforced.

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. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
1. Warranty Period: **Five** years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of **two** years.
1. Warranty includes removing and reinstalling protection board, drainage panels, insulation.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970/D 1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836/C 836M.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154/E 154M.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perm maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
 - 2. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.
- B. Modified Bituminous Sheet, Fabric Reinforced: Minimum 60-mil nominal thickness, self-adhering sheet consisting of rubberized-asphalt membrane with embedded fabric reinforcement, and with release liner on adhesive side.
 - 1. Physical Properties:
 - a. Pliability: No cracks when bent 180 degrees over a 1-inch mandrel at minus 25 deg F; ASTM D 146/D 146M.
 - b. Puncture Resistance: 100 lbf minimum; ASTM E 154/E 154M.
 - c. Water Vapor Permeance: 0.05 perm maximum; ASTM E 96/E 96M, Water Method.
 - 2. Sheet Strips: Self-adhering, reinforced, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.2 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch, predrilled at 9-inch centers.
- G. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - 1. Thickness: Nominal 1/4 inch.
 - 2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.
- H. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side or both sides with plastic film, nominal thickness 1/4 inch, with compressive strength of not less than 8 psi per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272/C 272M.
- I. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch thick.
- J. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. minimum density, 1-inch minimum thickness.

2.3 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel: Comply with Section 334600 "Subdrainage."
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft..
- C. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel without Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft..

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

3.2 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Seal edges of sheet-waterproofing terminations with mastic.
- F. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- H. Immediately install protection course with butted joints over waterproofing membrane.
 - 1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.3 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install **board insulation** before installing drainage panels.

3.4 INSULATION DRAINAGE-PANEL INSTALLATION

- A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 1326

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.
3. Spray-applied cellulosic insulation.

B. Related Requirements:

1. Section 07 5423 "Thermoplastic Polyolefin (TPO) Roofing" for insulation installed on roof.
2. Section 09 2900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative with a minimum of 5 years' experience who is trained and approved by manufacturer.

1.6 WARRANTY

- A. Provide manufacturer's standard warranties for all applicable products

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 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. Dow Chemical Company
 - b. DuPont de Nemours. Inc
 - c. Kingspan Insulation, Limited
 - d. Owens Corning.
 - 2. **All products installed below slab/grade must meet the required compressive strength requirements under the slab/grade.**

2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 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. CertainTeed Corporation
 - b. Johns Manville
 - c. Owens Corning

2.3 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Self-Supported, Spray-Applied Cellulosic Insulation ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), Type II (materials containing a dry adhesive activated by water during installation; intended only for enclosed or covered applications), chemically treated for flame-resistance, processing, and handling characteristics.

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.5 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for sections in which substrates and related work are specified and other conditions affecting performance.

- B. Do not apply insulation over wet substrate, or over substrate that has elevated moisture above and beyond what is the maximum recommended by the insulation manufacturer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.4 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of **24 inches** below slab.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100

SECTION 07 2500 – WATER-RESISTIVE BARRIERS AND AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wrap.
2. Flexible flashing.
3. Liquid based flashing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.3 WARRANTY

A. Provide manufacturer's standard warranties for all applicable products

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain water-resistive materials from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Manufactures:
 - a. VaproShield
 - b. Dow Chemical Company
 - c. DuPont

- d. Kingspan insulation Limited
 - e. Raven Industries, Inc
 - 2. Water-Vapor Permeance: Not less than **20 perms** per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 - 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
 - 4. Allowable UV Exposure Time: Not less than three months.
 - 5. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.3 FLEXIBLE FLASHING

- A. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch**.
- 1. Manufactures
 - a. Carlisle Coating & waterproofing
 - b. W.R Grace and Co.
 - c. Vaproshield
 - d. DuPont
 - 2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.
- C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

2.4 LIQUID BASED FLASHING & FLEXIBLE FLASHING

- A. Liquid-based Flexible Flashing: Elastomeric, liquid applied coating/ sealant, exhibiting the combined benefits of silicone and urethane. The liquid based flashing, when applied reacts with atmospheric moisture to form a waterproof, breathable, membrane. Flashing is based on silyl-terminated polyether polymers filled with environmentally safe pigments for body and color. This flashing is intended for difficult envelope closure conditions and unique instances such as CMU openings. See project details.
- 1. Products: Subject to compliance with requirements, provide one of the following product or comparable product approved in accordance with Division 01 Section “Product Substitutions”:
 - a. Building Envelope Innovations (BEI) PM-7000

PART 3 - EXECUTION**3.1 WATER-RESISTIVE BARRIER INSTALLATION**

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 6 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 07 2500

SECTION 07 2600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, **6-mil-** thick sheet, with maximum permeance rating of 0.1 perm.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. **CONTRACTOR IS RESPONSIBLE FOR INSTALLING A CONTINUOUS VAPOR BARRIER ON INTERIOR SIDE OF THE BUILDING FRAMING.**
- B. Place vapor retarders on side of construction indicated on Drawings.
- C. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- D. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 07 2600

SECTION 07 4213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concealed-fastener, lap-seam metal wall panels.

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. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 1. **Provide one of the provide one of the following justifying the submittal has adequate capacity to support the design loads.**
 - a. **ICC or IAPMO report, stating the allowable design**
 - b. **A licensed Washington state signed calculation package showing the fastening method is capable of supporting the design loads.**
- C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Two** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft..
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F , material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Concealed-Fastener Metal Wall Panels **MTL-2:**.
 1. **Manufacturer: Basis of Design- AEP Span.**
 - a. Other available manufacturer's:
 - 1) Taylor Metal Products
 2. **Product: Perception Collection- PC 30-12**
 3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: Cool Weathered Copper.
 4. Panel Coverage: 12 inches.
 5. Panel Height: 7/8 inches.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are

not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

- A. Panels and Accessories:
 - 1. Dura Tech 5000: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 METAL PANEL INSTALLATION

- A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 5. Flash and seal panels with weather closures at perimeter of all openings.
- B. Watertight Installation:
 - 1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
 - 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - 3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On

completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 4213.13

SECTION 07 4616 METAL SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum Cladding
2. Aluminum Cladding Components

B. Related Requirements:

1. Section 06 1000 Rough Carpentry
2. Section 07 6200 Sheet Metal Flashing and Trim
3. Section 07 9200 Joint Sealants

C. References:

1. American Society for Testing and Materials (ASTM)
 - a. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - b. ASTM D 958 - Practice for Determining Temperatures of Standard ASTM Molds for Test Specimens of Plastics.
 - c. ASTM E2768-11 – Standard Test Method for Extended Duration Surface Burning Characteristics for Building Materials (30 min Tunnel Test). Results: Zero Flame Spread, Smoke Developed Index of 5. Meets criteria for Class A fire rating
 - d. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - e. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method (NRC)
 - f. ASTM E1477 - Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers (LRV)
2. UL & Underwriters Laboratories of Canada (UL/ULC)
 - a. UL 723, Standard Method of Test for Surface Burning Characteristics of Building Materials.
 - b. CAN/ULC S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - c. CAN/ULC S114, Standard Test Method for determination of non-combustibility in building materials.
3. American Architectural Manufacturers Association (AAMA)
 - a. AAMA 2606-05 Voluntary Specification, Performance requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - b. AAMA 2604 - Voluntary Specification, Performance requirements and Test Procedures for High Performing Organic Coatings on Aluminum Extrusions and Panels.

- c. AAMA 2603 - Voluntary Specification, Performance requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- 4. International Code Council Evaluation Service (ICC-ES)
 - a. ICC-ES Evaluation Report.

1.2 WARRANTY

- A. Provide a written guarantee, signed and issued in the name of the owner, covering the metal cladding/siding material for 15 (fifteen) years from the date of Substantial Completion.
- B. The manufacturer's warranty is limited to replacement of defective material only, rather than installation of the same. Faulty installation shall be corrected by the installing contractor. The warranty required herein is the sole remedy against the manufacturer and there are no other implied warranties. In any event, the manufacturer shall not be liable for incidentals or consequential damages.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Submit duplicate 6 inch x 6 inch samples of siding materials, of color and profile specified.
- C. Shop drawings to indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, metal furring, and related work.
- D. Certificates: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- E. Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.6 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Longboard Products (Mayne Inc. #120)

2.2 Aluminum Cladding and Components

- A. 6 inch V-Groove planks extruded aluminum 6063 T5.
 - 1. Finish coating: powder coated finish.
 - 2. Color: Light Cherry
 - 3. Gloss: 30 ± 5 .
 - 4. Thickness: 1/16 inch V-Groove x 24 ft plank.

2.3 Accessories

- A. Exposed trim: 3/4" inside corner, 1" outside corner, 3" starter strip, 5/8" j-track, 1" x 1 3/8" two-piece j-track, 1 1/2" flat u-cap set, 1 3/8" compression joint, 1 3/8" termination set, 2" two-piece corner, 2 1/2" v-groove, 2 1/2" v-groove perforated in same material and finish as siding.
- B. Plank Clips: 316 stainless steel Quick-Screen clips that are shipped loose for field installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions.
- B. Install starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashing as required.
- C. Install outside corners, fillers and closure strips with carefully formed and profiled work.

- D. Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- E. Attach components in a manner not restricting thermal movement.

3.2 CLEANING

- A. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 07 4616

SECTION 07 5423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fully adhered thermoplastic polyolefin (TPO) roofing system.
2. Vapor retarder.
3. Roof insulation.
4. Coverboard.
5. Walkways.
6. Splash Block

B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 05 3100 "Steel Decking."

C. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETING

A. Preinstallation Roofing Conference: Conduct conference at construction site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 1. Base flashings and membrane terminations.
 2. Tapered insulation, including slopes.
 3. Roof plan showing orientation of steel roof deck and orientation of roofing.
 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:
 1. Sheet roofing, of color required.
 2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer s: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is **UL listed** for roofing system identical to that used for this Project.
- B. **Installer Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty. The firm shall have 5 years minimum verifiable experience installing similar systems.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Shipping wrapper is not to be considered weather protection.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. **Weather Limitations:** Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. **Workmanship Warranty:** Installer agrees to repair or replace components of roofing system that fail in workmanship within specified warranty period.
 - 1. Warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories and other components of roofing system.
 - 2. **Workmanship Warranty Period:** 5 years from date of Substantial Completion.
- B. **Manufacturer's System NDL Warranty:** Manufacturer agrees to repair or replace components of roofing system that fail in materials within specified warranty period.

1. Warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 1. Carlisle Syn Tec Incorporated
 2. Firestone Building Products
 3. Johns Manville
 4. Versico
 5. GAF
 6. Mule Hide
- B. Source Limitations: Obtain components including insulation and **fasteners** for roofing system from **manufacturer approved by membrane roofing manufacturer**.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
 1. Corner Uplift Pressure: 86 PSF
 2. Perimeter Uplift Pressure: 57 PSF
 3. Field-of-Roof Uplift Pressure: 34 PSF.
 4. Fire/Windstorm Classification: **Class 1A-90**.
 5. Hail-Resistance Rating: **MH**

2.3 TPO ROOFING

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
 - 1. Thickness: **60 mils** nominal.
 - 2. Exposed Face Color: **Gray**.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, **55 mils** thick, minimum, of same color as TPO sheet. **Contractor to submit locations and Architect to approved locations where product is to be used.**
- C. Bonding Adhesive: Manufacturer's standard.
- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
- G. 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.

2.5 VAPOR RETARDER / AIR BARRIER

- A. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards **approved** by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

- B. Polyisocyanurate Board Insulation: ASTM C 1289, **Type II, Class 1, Grade 2**, glass-fiber mat facer on both major surfaces.
 - 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. Carlisle Coatings & Waterproofing
 - b. Dow Chemical Company
 - c. DuPont de Nemours. Inc
 - d. Firestone Building Products
 - e. **GAF**
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of **1/4 inch per 12 inches** unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Full-spread spray-applied, low-rise, two-component urethane adhesive or other adhesive as required by the roofing manufacturer
- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, **1/2 inch thick, factory primed.**
 - 1. Georgia-Pacific Gypsum
 - 2. National gypsum Company
 - 3. USG Corporation

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway **pads** approximately 3/16 inch thick and acceptable to roofing system manufacturer.
 - 1. Width: Minimum 36"
 - 2. Boarder: Provide contrasting color at edges of walkways.

2.9 SPLASH BLOCKS

- A. Material: To be compatible with roof system.
- B. Size: To be sized for application

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:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has elapsed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Concrete substrate must be primed prior to the application of the vapor retarder.
- D. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system in compliance with the manufacturer's System Letter, and in general compliance with the recommendations set forth in the Roofing & Waterproofing Manual, published by the National Roofing Contractors Association, current edition.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition **and to not void warranty for existing roofing system.**

3.4 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Insulation boards shall not to exceed 4 feet by 4 feet in dimensions.
- D. Install tapered insulation under area of roofing to conform to slopes indicated.
- E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- H. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 2. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.
 - 1. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 - 2. Cover boards shall not exceed 4 feet x 4 feet in dimension.

3.6 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing. Provide peel stops as recommended by manufacturer.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, 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 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 roofing that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of 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 bar.**

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at 25% of installation and upon completion.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5423

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

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. Manufactured through-wall flashing.
2. Manufactured reglets with counterflashing.
3. Formed roof-drainage sheet metal fabrications.
4. Formed low-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.
6. Formed equipment support flashing.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For all sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof coping and cornice, approximately 4 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - 2. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
 - 5.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: 2D (dull, cold rolled).
- C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 2. Exposed Finishes: Apply the following coil coating:
 - a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:
 - a) Humidity Resistance: 2000 hours.
 - b) Salt-Spray Resistance: 2000 hours.
 - 2) Color: Match finish and color of metal roof panels where applicable. See those Sections for colors and finishes. For other applications, color to be selected by Architect from manufacturer's full range of available colors. See Color Schedule on drawings.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
1. Install one of the following products or approved equal:
 - a. Grace Construction's "Ultra,"
 - b. Protecto Wrap's "Protecto Jiffy Seal Ice & Water Guard HT,"
 - c. SDP Advanced Polymer's "Palisade SA-HT"
 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, **solder**, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal **or manufactured item** unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal **or manufactured item.**
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 4. Fasteners for **Zinc-Coated (Galvanized), Aluminum-Zinc Alloy-Coated** Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
 5. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
1. For Stainless Steel: ASTM B 32, **Grade Sn60**, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, **Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.**
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric **polyurethane** polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard **and by FM Global Property Loss Prevention Data Sheet 1-49** for application, but must be thicker than that of metal being secured.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Trim edges to be seamed, form seams, and solder. Seams on tops of coping greater than 12" wide are to be standing seam.
- I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. **Rivet joints where necessary for strength.**
- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. **Rivet joints where necessary for strength.**
- K. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Fabricate expansion joints, expansion-joint covers and gutter accessories from same metal as gutters.
1. Expansion Joints: Butt type.
 2. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen, mechanically fastened in place, wire ball downspout strainer, and valley baffles.
 3. Gutters: Material type, thickness, finish and color to match metal roofing, unless indicated otherwise on drawings. See Color Schedule on drawings.
- B. GUTTER SUPPORT BRACKETS AND SPACER BARS
1. Material: Provide of galvanized steel bar, size as indicated on drawings.
 2. Bend to shapes required.
 3. Drill holes of size and in locations required, ready for installation under Division 7 Section "Sheet Metal Flashing and Trim".
 4. Hot dip galvanize after fabrication. Clean, and prepare galvanizing, and then prime gutter support brackets with PPG Pitt Guard Rapid Coat D-T-R Epoxy Coating 95-245, 5 to 7 mils DFT, no substitutes. Field paint gutter support brackets with High Performance coating per Division 9 Section "High Performance Coatings", custom color to match roofing.
- C. STEEL DOWNSPOUTS AND ASSOCIATED BRACKETS
1. Material: Provide of standard weight ASTM A120 steel pipe, size and configuration as indicated on drawings.
 2. Provide with attachment brackets as indicated on drawings.
 3. All welds shall be continuous and ground smooth.
 4. Hot dip galvanize after fabrication. Clean, and prepare galvanizing, and then prime with PPG Pitt Guard Rapid Coat D-T-R Epoxy Coating 95-245, 5 to 7 mils DFT, no substitutes. Field paint with High Performance coating per Division 9 Section "High Performance Coatings", custom color to match roofing.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashings / Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
1. Joint Style: At all sheet metal copings over 4 inches in top width, fabricate and install with one-inch high standing seams following SMACNA recommendations. Provide with 45 degree end, tightly joined and full sealed with one-part urethane sealant between faying surfaces. Secure with continuous 22 gauge galvanized sheet metal cleats at exterior face, and domed-gasketed screws spaced 24 inches on center along the interior vertical face of coping centered on the height of the vertical leg. No expansion provisions are to be provided unless noted or detailed otherwise. Lap and seal all other joints 4 inches minimum.

2. Fabricate copings from the following material:
 - a. Prepainted, Metallic-Coated Steel: 24 gauge, unless a different material or thickness are indicated on the drawings.
 - b. **All copings are to be fully supported.**

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. All Metal Roof Related Flashing, except as noted herein: Fabricate from the following material:
 1. Material type, thickness, finish and color to match metal roofing, unless indicated otherwise on drawings. See Color Schedule on drawings.
- B. Roof Crickets:
 1. Stainless Steel: 20 gauge, unless indicated otherwise.

2.9 WALL SHEET METAL FABRICATIONS

- A. Openings Flashing in Frame Construction: Fabricate head, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings, unless indicated otherwise on drawings. Form head and flashing with 2-inch- (50-mm-) high end dams, unless indicated otherwise on drawings.
 1. Provide corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Where indicated on drawings to be aluminum flashing, form exposed flashing from sheet aluminum finished to match framing system and of sufficient thickness to maintain a flat appearance without visible deflection. See Aluminum Framed Entrance Systems and Louvers Sections and coordinate. Where indicated to be sheet metal flashing, provide in 24 gauge unless noted otherwise. Colors as indicated on the Color Schedule on the drawings.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Misc Flashings: Fabricate from the following material:
 1. For metal roofing, match thickness and color of roofing panels unless noted otherwise. For siding and other miscellaneous flashing, provide in 24 gauge unless noted otherwise. Provide in prepainted, metallic-coated steel unless noted otherwise. See Color Schedule on drawings.

2.11 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: 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 substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with a minimum of two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 50 feet (unless indicated otherwise on drawings) with no joints allowed within 24 inches of corner or intersection. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than ½" to ¾", unless recommended otherwise by manufacturer.
1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 2. Aluminum: Use aluminum or stainless-steel fasteners.
 3. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with butyl sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
 3. Flashing Lap Joints: At all lap joints in metal flashings, lap sheet metal a minimum of 4 inches, or more if recommend by SMACNA, or more if indicated on the drawings. Install at least two continuous beads of sealant in each lap joint within and fully concealed by the lap joint.
- I. Soldered and Welded Joints: Welded joints are preferred over soldered – weld whenever feasible. Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
1. Do not weld or solder prepainted, metallic-coated steel.
 2. Pretinning is not required for zinc-tin alloy-coated stainless steel.
 3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 4. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
 5. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with lapped joints sealed with butyl sealant and rivets. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets provided under Division 5 Section "Metal Fabrications" spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing as detailed.
 - 3. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart, unless indicated otherwise on drawings. Install expansion joint caps.
 - 4. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Provided under Division 5 Section "Metal Fabrications". Provide fasteners designed to hold downspouts securely 1 inch away from walls, unless detailed otherwise; locate fasteners at top and bottom and at approximately 60 inches o.c. in between, unless detailed otherwise.
 - 1. Provide elbows at base of downspout to direct water away from building, unless indicated otherwise.
 - 2. Connect downspouts to underground drainage system indicated, unless detailed otherwise.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing, unless detailed otherwise. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Openings Flashing in Frame Construction: Install continuous head, sill jamb, and similar flashings to extend 4 inches beyond wall openings, unless detailed otherwise.
- C. At wall openings that interrupt metal thru-wall flashings, bend end of flashing up to form 1/2" high end dams at all jambs. At sheet metal flashing end dams, fully seal corners. At stainless steel flashing, continuously weld corners.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

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 sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

SECTION 077200 - ROOF ACCESSORIES

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. Roof hatches.
 - 2. Pipe portals.
 - 3. Preformed flashing sleeves.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for metal vertical ladder for access to roof hatches.
 - 2. Section 07 6200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 3.

1.3 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
- B. Manufacturers: Subject to compliance with requirements, manufacturers provide on of the following:
 - 1. Babcock-Davis Hatchways, Inc.
 - 2. Bilco Company.
 - 3. Bristolite Skylights.
 - 4. Custom Curb, Inc.
 - 5. Dur-Red Products, Inc.
 - 6. Goeller Enterprises.
 - 7. Hi Pro International, Inc.
 - 8. J. L. Industries, Inc.
 - 9. Metallic Products Corporation.
 - 10. Milcor, Inc.
 - 11. Nystrom Products Co.
 - 12. O'Keeffe's Inc.
 - 13. Precision Stair Corporation.
 - 14. Roof Products & Systems Corp.
 - 15. ThyCurb, Inc,
 - 16. Trimco, Inc.
 - 17. Wasco Products, Inc.
 - 18. Architectural Specialties, Inc.
 - 19. Precision Ladders PLH Seeries Roof Hatch
- C. Type and Size: Single-leaf lid, **42 by 42 inches**.
- D. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- E. Hatch Material: Zinc-coated (galvanized) steel sheet.
 - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - 2. Finish: Baked enamel or powder coat.
 - 3. Color: As selected by Architect from manufacturer's full range
- F. Construction:
 - 1. Insulation: **Polyisocyanurate board**.
 - a. R-Value: **12.0** min according to ASTM C 1363.
 - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 4. Hatch Lid: Glazed, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

5. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 7. Fabricate curbs to minimum height of **12 inches** above roofing surface unless otherwise indicated.
 8. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is **tapered to accommodate roof slope so that top surfaces of perimeter curb are level**. Equip hatch with water diverter or cricket on side that obstructs water flow.
- G. Hardware: Spring operators, hold-open arm, **stainless**-steel spring latch with turn handles, **stainless**-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches above finished roof deck.
 3. Material: Stainless steel.
 4. Post: 1-5/8-inch diameter pipe.
 5. Finish: Stainless.

2.3 PIPE PORTALS

- A. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

2.4 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted or perforated metal collar.
1. Metal: Aluminum sheet, 0.063 inch thick.
 2. Diameter: As indicated on Drawings.
 3. Finish: Manufacturer's standard.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
1. Metal: Aluminum sheet, 0.063 inch thick.
 2. Height: 13 inches.
 3. Diameter: As indicated on Drawings.
 4. Finish: Manufacturer's standard.

2.5 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
4. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
2. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
3. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

C. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Clear Anodic Finish: AAMA 611, **AA-M12C22A41, Class I, 0.018 mm** or thicker.

4. Color Anodic Finish: AAMA 611, **AA-M12C22A42/A44, Class I, 0.018 mm** or thicker.
 5. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 7. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- D. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- G. Steel Tube: ASTM A 500/A 500M, round tube.
- H. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- I. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.6 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. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.
- C. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
- D. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, **containing no arsenic or chromium**, and complying with AWPA C2; not less than 1-1/2 inches thick.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. 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.

- H. 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.
- I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- J. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: 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 **uncoated aluminum** and **stainless-steel** 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.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

D. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

E. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

F. Roof Walkway Installation:

1. Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.
2. Remove ballast from top surface of low-slope roofing at locations of contact with roof-walkway supports.
3. Install roof walkway support pads prior to placement of roof walkway support stands onto low-slope roofing.
4. Redistribute removed ballast after installation of support pads.

G. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 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. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.

- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7200

SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
- B. Related Requirements:

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Provide products from the following manufacturer or approved equal:
 - a. 3M Fire Portection Products
 - b. Everkem Diversified Products, Inc
 - c. Hilti, Inc
 - d. Tremco
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.

2.2 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- C. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. 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.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

END OF SECTION 07 8413

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Polyurethane joint sealants.
4. Polysulfide joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant color.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 FIELD 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.

1.5 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 warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: **To be selected by Architect from manufacturer's full range.** Color will best match adjacent finishes.

2.2 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. BASF Building Systems.
 2. Dow Corning Corporation.
 3. GE Advanced Materials - Silicones.
 4. May National Associates, Inc.
 5. Pecora Corporation.
 6. Polymeric Systems, Inc.
 7. Schnee-Morehead, Inc.
 8. Sika Corporation; Construction Products Division.
 9. Tremco Incorporated.
 10. Bostik, Inc.
 11. Lymtal, International, Inc.
 12. Pacific Polymers International, Inc.
 13. Dayton Superior Specialty Chemicals.
 14. EMSEAL Joint Systems, Ltd.
 15. Sandell Manufacturing Co.
 16. Schul International, Inc.
 17. Willseal USA, LLC.
 18. USG Corporation.

2.3 SILICONE JOINT SEALANTS

- A. Silicone: Single-component (S) or multicomponent (M), pourable (P) or nonsag (NS), movement capability as recommended by manufacturer, traffic or nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920.

2.4 POLYURETHANE JOINT SEALANTS

- A. Polyurethane: Single-component (S) or multicomponent (M), pourable (P) or nonsag (NS), movement capability as recommended by manufacturer, traffic or nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.7 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 - 1. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, **Type C (closed-cell material with a surface skin)**, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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 performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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. 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 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.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - 4. Provide flush joint profile at locations indicated on Drawings and according to Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings and according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Responsibility: Contractor to provide a schedule of sealants proposed for use. Use only sealants which are tested for the proposed application and for which submitted data can be provided.
- B. Example Joint Sealant Schedule Entry:
 - 1. Description and composition:
 - 2. Products:

3. Type and Grade:
4. Class:
5. Use Related to Exposure:
6. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, granite, limestone, marble, ceramic tile, and wood.
7. Applications:

END OF SECTION 07 9200

SECTION 08 1113 – HOLLOW METAL DOORS AND FRAMES

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. Hollow-metal steel doors.
 - 2. Hollow-metal steel frames.
- B. Related Sections include the following:
 - 1. Division 8 Section “Flush Wood Doors” for wood doors installed in steel frames.
 - 2. Division 8 Section "Glazing" for glazed lites in standard steel doors and frames.
 - 3. Division 8 Section “Finish Hardware” for door hardware for steel doors.
 - 4. Division 9 section “Exterior Painting” for field painting steel doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 PERFORMANCE REQUIREMENTS

- A. Sound Rating: Provide sound-control door assemblies that have been fabricated and tested as sound-retardant units, are identical to assemblies tested according to ASTM E 90 by an independent testing agency, and have the following minimum certified STC rating according to ASTM E 413:

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance and temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each door design.

2. Details of doors, including vertical and horizontal edge details.
 3. Frame details for each frame type, including dimensioned profiles.
 4. Details and locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of anchorages, accessories, joints, and connections.
 7. Details of glazing frames and stops showing glazing.
- C. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware.
- D. Product Test Reports: Based on evaluation of comprehensive fire tests performed and sound ratings by a qualified testing agency, for each type of standard steel door and frame.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- B. Fire-Rated and Sound Control Door Sidelight and Transom Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
1. Test Pressure: Test according to UL 1784. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
 2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.
- C. Smoke-Control Door Assemblies: Comply with IBC 715.4.3.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify openings 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 opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate installation of anchorages for steel frames. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products by Curries Company; an ASSA ABLOY Group Company, or, Ceco Door Products; an ASSA ABLOY Group Company, or Steelcraft; an Ingersoll-Rand Company, or approved substitute.

2.2 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- B. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- D. Grout: Provide as required in Division 3 Section "Grout and Underlayments".
- E. Glazing: Comply with requirements in Division 8 Section "Glazing."
- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard polyisocyanurate core that produces doors complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 12.3 deg F x h x sq. ft./Btu when tested according to ASTM C 1363. Locations: Exterior doors and interior doors where indicated.
 - 3. Vertical Edges for Single-Acting Doors: Beveled Edge: 1/8 inch in 2 inches.
 - 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
 - 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick end closures or channels of same material as face sheets, fully welded.
 - 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior and Interior Doors: Face sheets fabricated from paintable A25 galvanized steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. 16 gauge, Model 2 (Seamless).
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
 - 1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 - 2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 - 3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
 - 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from paintable A25 galvanized steel sheet.
 - 1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.

2. 14 gauge thick steel sheet, unless otherwise indicated.
- C. Interior Frames: Fabricated from paintable A25 galvanized steel sheet
1. Fabricate frames with mitered or coped and fully welded face corners and seamless face joints.
 2. Frames Steel Doors: 14 gauge thick steel sheet, unless otherwise indicated.
 3. Frames for Wood Doors: 14 gauge thick steel sheet, unless otherwise indicated.
 4. Frames for Borrowed Lights: 14 gauge thick steel sheet, unless otherwise indicated.
- D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- F. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
- H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- I. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.
- 2.5 STOPS AND MOLDINGS
- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.6 FABRICATION

- A. General: Fabricate steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Steel Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
- C. Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Fully weld flush face joints and throats continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
 - 4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
 - 5. Where installed in masonry, leave vertical jambs in frames open at top for grouting. Do not grout mullions.
 - 6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 7. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches in height.
 - 2) Three anchors per jamb from 60 to 90 inches in height.
 - 3) Four anchors per jamb from 90 to 120 inches in height.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 120 inches in height.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches in height.
 - 2) Four anchors per jamb from 60 to 90 inches in height.
 - 3) Five anchors per jamb from 90 to 96 inches in height.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - 5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

8. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Finish Hardware."
 1. Reinforce doors and frames to receive non-templated mortised and surface-mounted door hardware.
 2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of doors and frames.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.7 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Finish standard steel door and frames after assembly.
- B. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants per SSPC SP3. After cleaning, apply a conversion coating suited to the organic and epoxy coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 1. Galvanizing Repair Paint: High-zinc-dust-control paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 82 percent zinc dust by weight, as recommended by the door manufacturer, and compatible with the primer specified in Division 9 Section "Painting".

- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Priming: Doors and frames to be field primed and painted.
- E. Protective Coating: For all steel frames, apply a coating of bituminous paint to all concealed portions of the frame, for both building interior and exterior frames. This coating shall extend over all surfaces of the concealed portions of the assembled frame to provide additional corrosion protection from moisture in the frame grout. Verify bituminous paint is compatible with UL tested Fire Ratings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Steel Frames: Install steel frames for doors sidelights transoms, and borrowed lights and other openings, of size and profile indicated. Comply with SDI 105.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply bituminous coating to all concealed surfaces of frames that are filled with mortar, grout, and plaster containing anti-freezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Grout frames as indicated on drawings. If no grout is indicated, solidly pack mineral-fiber insulation behind frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
 - 5. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
 - 6. Mullions: Do not grout closed tube type mullions, such as mullions between door and glass, or glass and glass.

- C. Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors according to IBC 715.4.3.
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 FIELD QUALITY CONTROL

- A. Testing agency: Owner may engage a qualified independent acoustical testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- C. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

END OF SECTION 08111

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with plastic-laminate faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 08 8000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Provide Samples for each color, texture, and pattern of plastic laminate required.
 - c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

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:
 - a. Eagle Plywood & Door Manufacturing, Inc.
 - b. Eggers Industries; Architectural Door Division.
 - c. GRAHAM Manufacturing Corp.
 - d. IPIK Door Company.
 - e. Lynden Door.
 - f. Mohawk Flush Doors, Inc.
 - g. Vancouver Door Company, Inc.
 - h. VT Industries Inc.
 - i. Weyerhaeuser Company.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. WDMA I.S.1-A Performance Grade:
 1. Extra Heavy Duty.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- D. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

E. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 PLASTIC-LAMINATE-FACED DOORS

A. Interior Solid-Core Doors per drawings

1. Grade: Premium.
2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
3. Colors, Patterns, and Finishes: per drawings.
4. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
5. Core: Particleboard, Glued wood stave or Structural composite lumber.
6. Construction: Three plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces are applied. Faces are bonded to core using a hot press.
7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.
8. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LIGHT FRAMES AND LOUVERS

- A. Metal trim for Light Openings in Wood Doors: Provide manufacturer's standard metal trim unless otherwise indicated.
1. Profile: Manufacturer's standard shape. Verify with Architect.
 2. Color: Architect to choose from Manufacturer's standard colors.
- B. Metal Louvers: Per mechanical drawings.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."

- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes access doors and frames for ceilings.
- B. Provide access doors for attic, ceiling or wall cavities that need access by code. Such spaces include, but are not limited to, the following.
 - 1. Mechanical or electrical equipment in attic (equipment platform).
- C. Related Requirements:
 - 1. Section 07 7200 "Roof Accessories" for roof hatches.
 - 2. Section 09 5423 "Linear Metal Ceilings" for access doors installed in decorative metal ceilings/soffits.

1.2 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material in specified finish.
- D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for vertical access doors and frames.
 - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 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. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- C. Steel Sheet: Electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating.
- E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Factory-Primed Finish: Manufacturer's standard shop primer.
 - 2. Baked-Enamel Finish: Minimum dry film thickness of 2 mils.
 - 3. Powder-Coat Finish: Thickness not less than 1.5 mils.
- F. Drywall Beads: 0.0299-inch zinc-coated steel sheet to receive joint compound.
- G. Plaster Beads: 0.0299-inch zinc-coated steel sheet with flange of expanded metal lath.
- H. Manufacturer's standard finish.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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. Acudor Products, Inc.
 - 2. Babcock-Davis; A Cierra Products Co.
 - 3. Bar-Co, Inc. Div.; Alfab, Inc.
 - 4. Cendrex Inc.
 - 5. Dur-Red Products.
 - 6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
 - 7. Jensen Industries.
 - 8. J. L. Industries, Inc.
 - 9. Karp Associates, Inc.
 - 10. Larsen's Manufacturing Company.
 - 11. MIFAB, Inc.

12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Ceiling.
2. Door: Minimum 0.060-inch- thick sheet metal.
3. Frame: Minimum 0.060-inch- thick sheet metal with 1-1/4-inch- wide, surface-mounted trim.
4. Hinges: Spring-loaded, concealed-pin type.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Certain fans above ceilings and equipment in walls need to be access by code. Contractor to coordinate and provide access panels by code for maintenance of electrical or mechanical equipment. Coordinate door locations with Architect. Provide schedule indicating size, locations, and depth of access doors.
- B. Comply with manufacturer's written instructions for installing access doors and frames.

- C. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- D. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 3113

SECTION 08 4113 - ALUMINUM-FRAMED ENTRANCES, CURTAIN WALLS AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for punched openings.
3. Exterior and interior manual-swing entrance doors and door-frame units.
4. Glazed aluminum curtain walls

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 construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

2. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Entrance Door Hardware Schedule: See Door Hardware 087100.

E. Delegated-Design Submittal: For, aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Energy Performance Certificates: For aluminum-framed entrances, curtain walls and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- C. Product Test Reports.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances, curtain walls and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 WARRANTY

- A. Special Warranty: **Manufacturer** agrees to repair or replace components of aluminum-framed entrances, curtain wall and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: **Five** years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Warranty Period: **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design aluminum-framed entrances, curtain walls and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Aluminum-framed entrances, curtain walls and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings or per local codes.
- D. Deflection of Framing Members: At design wind pressure, as follows:
 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite

- limit or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
- E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at **150** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **0.2** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **10** seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement.
- I. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor as show on the drawings.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient as show on the drawings.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than **25** as determined according to NFRC 500.
- J. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for **Wind Zone 1**

1. Large-Missile Test: For glazed openings located within 30 feet of grade.
- K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ALUMINUM FRAMED INTERIOR STOREFRONTS: SF-1

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
 1. Kawneer Company Inc.
 2. Interior: Trifab™ VersaGlaze 450 Framing System
 3. System Dimensions: 1 3/4" x 4-1/2"
 4. Glass: Center
- B. Subject to compliance with requirements, provide a comparable product by, but not limited to, the following:
 1. Arcadia, Inc
 2. EFCO Corporation
 3. US Aluminum
 4. Vistawall Architectural Products.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.
- D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Non Thermal performance
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center
 4. Finish: Black anodic finish
 5. Fabrication Method: Field-fabricated stick system.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 ALUMINUM FRAMED EXTERIOR STOREFRONTS: SF-2

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
 1. Kawneer Company Inc.
 2. Exterior: Trifab™ 451 Framing System
 3. System Dimensions: 2" x 4-1/2"

4. Glass: Center
- B. Subject to compliance with requirements, provide a comparable product by, but not limited to, the following:
1. Arcadia, Inc
 2. EFCO Corporation
 3. US Aluminum
 4. Vistawall Architectural Products.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.
- D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center
 4. Finish: Black anodic finish
 5. Fabrication Method: Field-fabricated stick system.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- G. **Seismic Support: Heavy duty intermediate verticals are to be used in order to provide 10psf lateral loads.**

2.4 ALUMINUM FRAMED EXTERIOR STOREFRONTS: SF-3

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
1. Kawneer Company Inc.
 2. Exterior: Trifab™ 451T (Thermal) Framing System
 3. System Dimensions: 2" x 4-1/2"
 4. Glass: Center
- B. Subject to compliance with requirements, provide a comparable product by, but not limited to, the following:
1. Arcadia, Inc
 2. EFCO Corporation
 3. US Aluminum
 4. Vistawall Architectural Products.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

- D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Center
 - 4. Finish: Black anodic finish
 - 5. Fabrication Method: Field-fabricated stick system.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.5 ALUMINUM FRAMED CURTAIN WALLS: CW-1

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
 - 1. Kawneer Company Inc.
 - 2. Exterior: 1600UT System 1 Curtain Wall
 - 3. System Dimensions: 1" double glazed insulating glass: 2-1/2" x 7-1/2", outside glazed pressure plate format
- B. Subject to compliance with requirements, provide a comparable product by, but not limited to, the following:
 - 1. Arcadia, Inc
 - 2. EFCO Corporation 5600 2.5" curtain wall
 - 3. US Aluminum 3150 2.5" curtain wall
 - 4. Vistawall Architectural Products.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.
- D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Center
 - 4. Finish: Black anodic finish
 - 5. Fabrication Method: Field-fabricated stick system.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.6 ALUMINUM FRAMED CURTAIN WALLS: CW-2

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
1. Kawneer Company Inc.
 2. Exterior: 1600UT System 1 Curtain Wall
 3. System Dimensions: 1" double glazed insulating glass: 2-1/2" x **10-1/2"**, outside glazed pressure plate format
- B. Subject to compliance with requirements, provide a comparable product by, but not limited to, the following:
1. Arcadia, Inc
 2. EFCO Corporation 5600 2.5" curtain wall
 3. US Aluminum 3150 2.5" curtain wall
 4. Vistawall Architectural Products.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.
- D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center
 4. Finish: Black anodic finish
 5. Fabrication Method: Field-fabricated stick system.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.7 MATERIALS:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

- a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
- b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
- c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.8 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Medium stile; 3-1/2-inch nominal width
 - 3. Glazing Stops and Gaskets: Beveled snap-on, extruded-aluminum stops and preformed gaskets.

2.9 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: See Section 08 7100 "Door Hardware."

2.10 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers
- C. Glazing Sealants: As recommended by manufacturer.

2.11 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

2.12 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from **exterior**.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.13 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, **AA-M12C22A32/A34, Class II, 0.010 mm** or thicker.

1. Color: **Black**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
1. Comply with manufacturer's written instructions.
Fit joints to produce hairline joints free of burrs and distortion.
 2. Rigidly secure nonmovement joints.
 3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- B. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- E. Install glazing as specified in Section 088000 "Glazing."

- F. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: If desired, Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 08 4113

SECTION 08 5113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes sliding, aluminum service windows.

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. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. Window: **10** years from date of Substantial Completion.
 - b. Glazing Units: **10** years from date of Substantial Completion.
 - c. Aluminum Finish: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

- 1. Window Certification: AAMA certified with label attached to each window.

2.2 ALUMINUM WINDOWS

- A. Operating Types: **Sliding**.

- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

- C. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.

- 1. Kind: Fully tempered.

- D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

- E. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.

- 1. Exposed Hardware Color and Finish: Black to match storefront system.

- F. Horizontal-Sliding Window Hardware:

- 1. Sill Cap/Track: Designed to comply with performance requirements indicated.
 - 2. Locks and Latches: Operated from the inside only.
 - 3. Roller Assemblies: Low-friction design.

- G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

- 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 ACCESSORIES

- A. Receptor System: **Window is to be installed within an interior storefront system.** Provide necessary accessories for this type of installation.

2.4 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

- B. Glaze aluminum windows in the factory.

- C. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.5 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - 1. Color: **Black**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- E. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 5113

SECTION 08 7100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work under this section includes the complete finish hardware requirements for the project. Quantities listed are for the contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.
- B. Related Sections:
 - 1. Section 08 Hollow Metal Doors and Frames
 - 2. Section 08 Wood Doors
 - 3. Section 08 Aluminum Entrances and Storefronts
 - 4. Section 28 Electronic Security and Safety

1.2 QUALITY ASSURANCE

- A. Product Qualification:
 - 1. To assure a uniform high quality of materials for the project, it is intended that only specified items be furnished. Comparable products may be accepted upon prior approval of architect.
 - 2. Hardware to be new, free of defects, blemishes and excessive play. Obtain each kind of hardware (Mechanical latch and locksets, exit devices, hinges and closers) from one manufacturer except where specified.
 - 3. Fire-Rated opening in compliance with NFPA80. Hardware UL10C/UBC-7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved bearing hinges and smoke seal. Furnish openings complete.
- B. Supplier Qualifications:
 - 1. Hardware supplier will be a direct factory contract supplier who employs a certified Architectural Hardware Consultant (AHC) available at all reasonable times during the work for project hardware consultation to owner, architect and contractor.
 - 2. Supplier will be responsible for detailing, scheduling and ordering of finish hardware.
 - 3. Conduct pre-installation conference at jobsite. Initiate and conduct with supplier, installer and related trades. Coordinate materials and techniques and sequence complex hardware items and systems installation.
 - 4. Key Conference shall be initiated and conducted with owner to determine system, keyway(s) and structure.
- C. Installer Qualifications:

1. Installer to have not less than 3 years' experience specializing in installation of work in this section. Company must maintain qualified personnel trained and experienced in installing hardware.

1.3 REFERENCES

- A. IBC – International Building Code
- B. NFPA80 – Fire Doors and Windows
- C. NFPA101 – Life Safety Code
- D. NFPA105 – Smoke and Draft Control Door Assemblies
- E. ANSI A117.1 - Accessible and Usable Buildings and Facilities
- F. BHMA – Builders Hardware Manufacturers Association
- G. DHI – Door Hardware Institute

1.4 SUBMITTALS

- A. Hardware schedule: Submit digital copies of schedule. Organize vertically formatted schedule into Hardware Sets with index of doors and headings, indicate complete designations of every item required for each door or opening. Include the following:
 - 1. Type, style, function, size, quantity and finish of hardware items.
 - 2. Name, part number and manufacture of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Explanation of abbreviations, symbols and codes contained in schedule.
 - 5. Door and frame sizes, materials and degrees of swing.
- B. Product Data: Submit digital copies for each product indicated.
- C. Templates: Obtain and distribute templates for doors, frames, and other works specified to be prepared for installing door hardware.
- D. Wiring/Riser diagrams: As required for electric hardware indicated.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.
- F. Keying Schedule: Prepared by or under the supervision of supplier, after receipt of the approved finish hardware schedule, detailing Owner's final keying instructions for locks.
- G. Samples: Upon request submit material samples.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle and protect products to project site under provisions of Division 1 and as specified herein.
- B. Tag each item or package separately, with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver keys to Owner by registered mail.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers: Thirty years
 - b. Automatic operators: Two years
 - c. Exit Devices, Electrical: One year
 - d. Exit Devices, Mechanical: Three years
 - e. Locksets, Cylindrical: Ten years
 - f. Locksets, Mortise: Three years

1.7 MAINTENANCE

- A. Maintenance tools:
 - 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

- A. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.
- B. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation.

2.2 MANUFACTURERS

- A. Approval of products from manufacturers indicated as "Acceptable Manufacturer" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

ITEM	SCHEDULED MANUFACTURER	ACCEPTABLE MANUFACTURER
Hinges	Ives (IVE)	Hager, Stanley
Locksets & Deadlocks	Schlage (SCH)	Best, Sargent
Exit Devices – Bar Type	Von Duprin (VON)	Corbin-Russwin ED7000/ED3000 Series, Sargent 90 Series
Exit Devices & Mullions	Von Duprin (VON)	Precision, Sargent
Electric Strikes	Von Duprin (VON)	Trine, SDC
Power Supplies	Von Duprin (VON)	Precision, Sargent
Cylinders & Keying	Schlage (SCH)	Best, Sargent
Door Closers	LCN (LCN)	Norton, Sargent
Automatic Operators	LCN (LCN)	Stanley, Besam
Door Trim	Ives (IVE)	Trimco, Burns
Protection Plates	Ives (IVE)	Trimco, Burns
Overhead Stops	Glynn-Johnson (GLY)	Rixson, Sargent
Thresholds & Weatherstrip	Zero (ZER)	NGP, Reese, Pemko

2.3 HANGING

- A. Conventional Hinges: Hinge open width minimum, but of sufficient throw to permit maximum door swing. Steel or stainless-steel pins:
1. Three hinges per leaf to 7 feet, 6-inch height. Add one for each additional 30 inches in height or any fraction thereof.
 2. Provide standard-weight 4 ½ x 4 ½ for 1 ¾" thick doors up to 3'5". Provide heavy-weight 5 x 4 ½ on doors 36" and over.
 3. Exterior outswing doors to have non removable (NRP) pins.
 4. Pin tips, flat button, finish to match leaves.
 5. Interior doors over 36" – Heavy weight.
 6. Interior doors up to 36" – Standard weight.

2.4 LOCKSETS, LATCHSETS, DEADBOLTS

- A. Heavy Duty Mortise Locks and Latches: Schlage L9000 Series
1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security.
 2. Provide lock case that is multi-function and field reversible for handing without opening case, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
 3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
 4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

5. Provide electrified options as scheduled in the hardware sets.
6. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

a. Lever Design: Schlage Latitude

B. Extra Heavy Duty Cylindrical Locks and Latches: Schlage ND Series

1. Provide cylindrical locks conforming to ANSI A156.2 Series 4000, Grade 1.
2. UL listed for A label and lesser class single doors up to 4ft x 8ft.
3. Meets A117.1 Accessibility Codes.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Lever Design: Schlage Latitude

2.5 EXIT DEVICES

A. Panic and Fire Rated Exit Devices: Von Duprin 55/88 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide bar type exit devices, cast or forged of brass, bronze, or stainless steel, plated to standard architectural finishes to match balance of the door hardware.
4. Latch Bolt Throw: 3/4 inch (19 mm) for rim and mortise devices, 5/8 inch (16 mm) for surface and concealed vertical rod devices.
5. Mechanism Case: One piece without cover plate. Mount flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
6. Provide UL labeled fire exit devices for fire rated openings.
7. Provide manufacturer's standard strikes.
8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Provide electrified options as scheduled in the hardware sets.
11. Furnish all necessary wood door kits and cover plates, for proper installation of exit device.
12. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
13. Special Options:

- a. HH: Provide wind and impact rated hurricane exit devices and mullions certified to comply with Florida Building Code (FBC) TAS 201, 202, 203.
- b. HW: Provide wind rated hurricane exit devices and mullions certified to comply with ANSI-ASTM E330.

B. Panic and Fire Rated Exit Devices: Von Duprin 98/99 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Provide compression springs in devices, latches, and outside trims or controls; tension springs also acceptable.
4. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide exit devices with manufacturer's approved strikes.
6. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
7. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
8. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
9. Provide UL labeled fire exit hardware for fire rated openings.
10. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
11. Provide electrified options as scheduled.
12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever Style: Match lever style of locksets.

2.6 ELECTRIC STRIKES

A. Manufacturers and Products: Von Duprin 6000 Series

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.7 KEYS, KEYING, AND KEY CONTROL

A. See Keying Requirements in this section

2.8 CLOSERS

A. Surface Closers: LCN 4040XP Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
4. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
5. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
6. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
9. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 AUTOMATIC OPERATORS

A. Electro-Hydraulic Automatic Operator: LCN 4600 Series

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
6. Provide drop plates, brackets, or adapters for arms as required for details.
7. Provide hard-wired actuator switches for operation as specified.
8. Provide weather-resistant actuators at exterior applications.
9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence

operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.10 OTHER HARDWARE

A. Door stops: Provide stops to protect walls, casework or other hardware.

1. Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.
2. Where wall or floor stops are not appropriate, provide overhead holders.

B. Weatherstrip and Gasket

1. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled.
2. Provide non-corrosive fasteners as recommended by the manufacturer for application indicated.

C. Thresholds

1. Except as otherwise indicated, provide standard metal threshold unit of type, size and profile as detailed or scheduled.

D. Silencers

1. Interior hollow metal frames, 3 for single doors, 2 for pairs of doors.

E. Kickplates

1. Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

2.11 HARDWARE FINISH

A. Provide the following finishes unless noted differently in hardware groups:

Hinges	630 Stainless Steel Exterior, 652 Dull Chrome Interior
Locksets	626 Dull Chrome
Exit Devices	626 Dull Chrome
Closers	689 Aluminum
Kickplates	630 Stainless Steel
Other Hardware	626 Dull Chrome
Thresholds	Aluminum
Weatherstrip/Sweeps	Aluminum

2.12 KEYING REQUIREMENTS

- A. All keyed cylinders shall be subject to a new Schlage Masterkey system.
- B. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- C. Cylinders to be furnished with visual key control with key code. Stamped on the face of the keys and marked on the back or side of the cylinders.
- D. Initiate and conduct key conference with Owner to determine correct keyway(s) and structure. Owners written approval required prior to ordering product.
- E. Key Quantities
 - 6 EA Master Keys
 - 4 EA Control Keys
 - 2 EA Construction Control Keys
 - 10 EA Construction Keys
 - 3 EA Change Keys per keyed alike group

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure that walls and frames are square and plumb before hardware installation.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes. Notify Architect of any code conflicts before ordering materials.

3.2 INSTALLATION

- A. Do not install surface mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.
- B. Locate floor stops not more than 4 inches from the wall.
- C. Drill pilot holes for fasteners in wood doors and/or frames.

3.3 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.

- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.4 DEMONSTRATION

- A. Demonstrate electrical, electronic and pneumatic hardware system including adjustment and maintenance procedures.

3.5 PROTECTION/CLEANING

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.6 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

3.7 HARDWARE SETS:

HW SET: 01

DOORS: S02A

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-990		626	VON
1	EA	RIM IC CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	8197AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS		LGR	SCE
1	EA		CARD READER - PER SECURITY			
			VENDOR			

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY RETRACTS LATCH. INSIDE ALWAYS FREE FOR IMMEDIATE EGRESS.

HW SET: 02

DOORS: 133

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE		630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	8197AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA		CARD READER - PER SECURITY			
			VENDOR			
1			POWER SUPPLY - PER			
			SECURITY VENDOR			

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 03

DOORS: 230, 231

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 04

DOORS: 105, 106, 107, 110, 111, 112, 113, 205, 206, 209, 211, 212, 213, 214, 216, 217, 222

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D LAT		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 05

DOORS: 116, 201

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	 ⚡	630	VON
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 06

DOORS: 120

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 07

DOORS: 104B, 135, 202, 204, 232A, 232B

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 08

DOORS:102B

2	EA	PIVOT SET	7226 SET		622	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		622	IVE
1	EA	PANIC HARDWARE	5547-EO-LBR		622	VON
1	EA	PANIC HARDWARE	ES-5547-NL-OP-LBR		622	VON
1	EA	RIM CYLINDER	20-057 ICX		622	SCH
1	EA	FSIC CORE	23-030		622	SCH
1	EA	ELECTRIC STRIKE	6213 FSE	 ⚡	630	VON
2	EA	LONG DOOR PULL	9264F 72" O		BLK	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH X 4040-30 X 4040-61		622	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		693	LCN
2	EA	MEETING STILE	8194BK		BK	ZER
1	EA		CARD READER - PER SECURITY VENDOR	⚡		
1	EA		GASKETING BY DOOR/FRAME SUPPLIER			
1			POWER SUPPLY - PER SECURITY VENDOR			

DURING HOURS OF OPERATION: DOOR PUSH/PULL. ELECTRIC STRIKE UNLOCKED TO ALLOW FREE ENTRY. DOOR WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.
 OUTSIDE OF HOURS OF OPERATION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 09

DOORS: 103, 132, C201

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP EDA X 4040-61		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 10

DOORS: 104A

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 11

DOORS: 136

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 12

DOORS: 228

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 13

DOORS: 126

4	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 14

DOORS: 117, 124, 125, 127, 128, 129, 130, 224, 225, 226, 227

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY INDICATOR LOCK	L9056P6 LATA 09-544 L283-722		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	COAT AND HAT HOOK	572		626	IVE

HW SET: 15

DOORS: S02B, S02C

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	LD-98-L-BE-LAT		626	VON
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A		A	ZER

HW SET: 16STC

DOORS: 218, 221, 229

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	119WB PSA		B	ZER
1	SET	JAMB SEAL SYSTEM	870AA		AA	ZER
1	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 17

DOORS: 109

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA X 4040-61		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 18STC

DOORS: 108, 114, 207, 219, 220

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D LAT		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	119WB PSA		B	ZER
1	SET	JAMB SEAL SYSTEM	870AA		AA	ZER
1	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER

HW SET: 19

DOORS: 132A

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	RIM IC CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	ELECTRIC STRIKE	6211 FS 12/16/24/28 VAC/VDC	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	8194AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
2	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

NO FREE EGRESS--AHJ APPROVAL REQUIRED. RECOMMEND OBTAINING PRIOR TO ORDERING

CR + ES FSDOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL UNLOCK UPON LOSS OF POWER. NO FREE EGRESS THROUGH THIS DOOR.

HW SET: 20

DOORS: 121A

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	LONG DOOR PULL	9264F 72" O		630	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 21STC

DOORS: 122A

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	119WB PSA		B	ZER
1	SET	JAMB SEAL SYSTEM	870AA		AA	ZER
1	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER

HW SET: 22STC

DOORS:134A, C202

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	 ⚡	630	VON
1	EA	MOUNTING BRACKET	MB1		689	IVE
1	EA	SURFACE CLOSER	4040XP EDA ST-1754		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	119WB PSA		B	ZER
1	SET	JAMB SEAL SYSTEM	870AA		AA	ZER
1	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	CARD READER - PER SECURITY		⚡		
		VENDOR				
1		POWER SUPPLY - PER				
		SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 23STC

DOORS: 134B

4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	⚡	630	VON
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040-18TJ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	119WB PSA		B	ZER
1	SET	JAMB SEAL SYSTEM	870AA		AA	ZER
1	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 24

DOORS: 121B, 122B

1	EA	PIVOT SET	7226 SET		689	IVE
1	EA	INTERMEDIATE PIVOT	7226 INT		689	IVE
1	EA	POWER TRANSFER	EPT10	⚡	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-33A-NL-OP	⚡	626	VON
1	EA	RIM IC CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 12" O		630-316	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		689	LCN
1	EA	DOOR SWEEP	8197AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS	⚡	LGR	SCE
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1	EA	GASKETING BY DOOR/FRAME SUPPLIER				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY RETRACTS LATCH. INSIDE ALWAYS FREE FOR IMMEDIATE EGRESS.

HW SET: 25

DOORS:102A

2	EA	PIVOT SET	7226 SET		622	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		622	IVE
2	EA	PANIC HARDWARE	5547-EO		622	VON
2	EA	SURFACE CLOSER	4040XP SCUSH X 4040-30 X 4040-61		622	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA		693	LCN
2	EA	MEETING STILE	8194BK		BK	ZER
2	EA	DOOR SWEEP	8197BK		BK	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	GASKETING BY DOOR/FRAME SUPPLIER				

HW SET: 26

DOORS:101B

2	EA	PIVOT SET	7226 SET		622	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		622	IVE
2	EA	LONG DOOR PULL	PR 9266F 72" N MB		BLK	IVE
1	EA	OH STOP	100S		BLK	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH X 4040-30 X 4040-61		622	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS FLUSH CEILING MOUNT	 ⚡	693	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		693	LCN
1	EA	ACTUATOR, TOUCH	8310-818T	 ⚡	630	LCN
2	EA	DOOR SWEEP	39BK		BK	ZER
2	EA	MEETING STILE	8194BK		BK	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	GASKETING BY DOOR/FRAME SUPPLIER				

VERIFY ACTUATOR SIZE PRIOR TO ORDERING.

DOOR NORMALLY CLOSED AND UNLOCKED. ACTUATOR ACTIVATES AUTOMATIC OPERATOR.
FREE EGRESS AT ALL TIMES.

HW SET: 27STC

DOORS: 137B

2	EA	PIVOT SET	7226 SET		622	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		622	IVE
1	EA	PANIC HARDWARE	5547-EO		622	VON
1	EA	PANIC HARDWARE	5547-NL-OP		622	VON
1	EA	RIM CYLINDER	20-057 ICX		622	SCH
1	EA	FSIC CORE	23-030		622	SCH
2	EA	LONG DOOR PULL	9264F 72" O		BLK	IVE
2	EA	OH STOP	100S		BLK	GLY
2	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040XP-18TJ		622	LCN
1	SET	ADJUSTABLE GASKETING	870BK-S		BK	ZER
2	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
2	EA	MEETING STILE	8194BK		BK	ZER
1	EA	THRESHOLD	545A		A	ZER

HW SET: 28STC

DOORS: 137B

2	EA	PIVOT SET	7226 SET		622	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		622	IVE
1	EA	PANIC HARDWARE	5547-EO		622	VON
1	EA	PANIC HARDWARE	ES-5547-NL-OP-LBR		622	VON
1	EA	RIM CYLINDER	20-057 ICX		622	SCH
1	EA	FSIC CORE	23-030		622	SCH
1	EA	ELECTRIC STRIKE	6213 FSE	 ⚡	630	VON
2	EA	LONG DOOR PULL	9264F 72" O		BLK	IVE
1	EA	OH STOP	100S		BLK	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040XP-18TJ		622	LCN
1	EA	SURF. AUTO OPERATOR	4631 WMS 120 VAC	 ⚡	693	LCN
2	EA	ACTUATOR, TOUCH	8310-818T	 ⚡	630	LCN
1	SET	ADJUSTABLE GASKETING	870BK-S		BK	ZER
2	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
2	EA	MEETING STILE	8194BK		BK	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

VERIFY ACTUATOR SIZE PRIOR TO ORDERING.

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL MOMENTARILY UNLOCK ELECTRIC STRIKE AND ALLOW ACTIVATION OF ACTUATOR. ACTIVATING ACTUATOR WILL ACTIVATE AUTOMATIC OPERATOR. STRIKE LOCKS UPON LOSS OF POWER. LCN 4631 ACTUATOR HAS INTEGRAL ON/OFF SWITCH. FREE EGRESS AT ALL TIMES.

HW SET: 29

DOORS: 101A

2	EA	PIVOT SET	7226 SET		622	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		622	IVE
1	EA	PANIC HARDWARE	5547-EO		622	VON
1	EA	PANIC HARDWARE	ES-5547-NL-OP-LBR		622	VON
1	EA	RIM CYLINDER	20-057 ICX		622	SCH
1	EA	FSIC CORE	23-030		622	SCH
1	EA	ELECTRIC STRIKE	6213 FSE	 ⚡	630	VON
2	EA	LONG DOOR PULL	9264F 72" O		BLK	IVE
1	EA	OH STOP	100S		BLK	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH X 4040-30 X 4040-61		622	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS FLUSH CEILING MOUNT	 ⚡	693	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA		693	LCN
1	EA	ACTUATOR, TOUCH	8310-818T	 ⚡	630	LCN
1	EA	RELAY/DOOR SEQUENCER	8310-845	 ⚡	689	LCN
1	EA	ACUTATOR DBL NARROW ARROW	8310-855 INT. VESTIBULE DOUBLE BUTTON. ONE BUTTON OPERATES 101A, ONE BUTTON OPERATES 101B.	 ⚡	630	LCN
2	EA	MEETING STILE	8194BK		BK	ZER
2	EA	DOOR SWEEP	8197BK		BK	ZER
1	EA	THRESHOLD	545A		A	ZER
1	EA		CARD READER - PER SECURITY VENDOR	⚡		
1	EA		GASKETING BY DOOR/FRAME SUPPLIER			
1			POWER SUPPLY - PER SECURITY VENDOR			

VERIFY ACTUATOR SIZE PRIOR TO ORDERING.

DURING HOURS OF OPERATION: DOOR PUSH/PULL. ELECTRIC STRIKE UNLOCKED TO ALLOW FREE ENTRY. INTERIOR ACTUATOR WILL AUTOMATICALLY OPEN ACTIVE LEAF OF INNER AND OUTER DOOR SEQUENTIALLY. OUTSIDE ACTUATOR WILL AUTOMATICALLY OPEN ACTIVE LEAF OF INNER DOOR. AUTOMATIC OPERATOR WILL DISABLE ON LOSS OF POWER. DOOR WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

OUTSIDE OF HOURS OF OPERATION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 30STC

DOORS: 115, 223

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	119WB PSA		B	ZER
1	SET	JAMB SEAL SYSTEM	870AA		AA	ZER
1	EA	AUTO DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	545A		A	ZER

HW SET: 31

DOORS: 118, 119, 131

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CARD READER - PER SECURITY VENDOR		⚡		
1		POWER SUPPLY - PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HW SET: 32

DOORS: 210, 215

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S LAT		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 33

DOORS: 132B

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-LAT		626	VON
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	8194AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER

HW SET: 34

DOORS: 123

4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY INDICATOR LOCK	L9056P6 LATA 09-544 L283-722		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS436		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	COAT AND HAT HOOK	572		626	IVE

HW SET: 35

DOORS: F-1 PERSON GATE

1	EA	ANTI-VANDAL PLATE BY GATE MANUFACTURER				
1	EA	SELF-CLOSING HINGES BY GATE MANUFACTURER				
1	EA	STOREROOM LOCK	ND80P6D LAT		626	SCH
1	EA	ELECTRIC STRIKE	EN400			TRN
		SUPPLIER TO VERIFY NECESSARY COMPONENTS PRIOR TO ORDERING				
1	EA	CARD READER – PER SECURITY VENDOR				
1		POWER SUPPLY – PER SECURITY VENDOR				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL UNLOCK ELECTRIC STRIKE. STRIKE WILL LOCK UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass for windows, doors, storefront framing, borrowed lights and glazed curtain walls.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
- C. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
 - 1. Section 08 4113 "Aluminum Framed Entrances."
 - 2. Section 08 8300 "Mirrors."

COORDINATION

- D. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of **glass product** 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass.
- B. Preconstruction adhesion and compatibility test report.

- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: **10** years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. For purposes of establishing minimum performance standards, this specification is based on the following: Vitro Architectural Glass; Glass Technology Center, 400 Guys Run Rd., Pittsburgh, PA 15024. ASD. Toll Free Tel: (800) 887-6457. Fax: (800) 367-2986.
- B. Available Glass Manufacturers and Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to:
 - 1. AFG Industries
 - 2. Ford Glass Division
 - 3. Guardian Industries
 - 4. Pilkington Libbey-Owens-Ford
- C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
 - 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites **of thickness indicated**.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of **the SGCC or another certification agency acceptable to authorities having jurisdiction**. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. **Provide glass that complies with performance requirements and is not less than the thickness indicated.**
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass **as needed to comply with "Performance Requirements" Article**. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass **as needed to comply with "Performance Requirements" Article**. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with **polyvinyl butyral interlayer, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer** to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with **manufacturer's standard** primary and secondary sealants.
 - 2. Spacer: **Manufacturer's standard spacer material and construction.**
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: **As selected by Owner from manufacturer's full range.**
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.8 GLAZING TAPES

- A. Back-Bedding Mastix Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer

rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type C (closed-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.3 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.7 MONOLITHIC GLASS SCHEDULE

- A. Glass Type for interior windows and doors (Non-acoustic): Clear fully tempered float glass.
 - 1. Minimum Thickness: 1/4"
 - 2. Safety glazing where required per code.
- B. Glass Type for interior windows and doors (Acoustic): Clear fully tempered float glass.
 - 1. Minimum Thickness: 3/8" laminated.
 - 2. Safety glazing where required per code.

3.8 INSULATING GLASS SCHEDULE

- A. **North & East Facing Glass & South Facing Glass in Main Stairwell:** Glass Type for exterior windows and doors: Low-E-coated, clear insulating glass.
 - 1. Basis-of-Design Product: Solarban 60 (2) Clear + Clear by Vitro Architectural Glass.
 - 2. Performance Values: VLT 70 percent; SHGC 0.39 max; exterior reflectance 11 percent; U-value winter 0.24; U-value summer 0.22.
 - 3. Insulating Glass Unit Construction: 1/4 inch Clear glass, Solarban 60 solar control (sputtered) on second surface (2) + 1/2 inch argon filled space + 1/4 inch Clear (transparent) float glass
 - 4. Safety glazing as required.
- B. **South and West Facing Glass:** Glass Type for exterior windows and doors: Low-E-coated, clear insulating glass.
 - 1. Basis-of-Design Product: Solarban 70 (2) Clear + Clear by Vitro Architectural Glass.
 - 2. Performance Values: VLT 64 percent; SHGC 0.27 max; exterior reflectance 13 percent; U-value winter 0.24; U-value summer 0.21.
 - 3. Insulating Glass Unit Construction: 1/4 inch Clear glass, Solarban 70 solar control (sputtered) on second surface (2) + 1/2 inch argon filled space + 1/4 inch Clear (transparent) float glass
 - 4. Safety glazing as required.

END OF SECTION 08 8000

SECTION 08 8300 - MIRRORS

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 the following types of silvered flat glass mirrors:
 - 1. Tempered glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTAL

- A. Product Data: For each type of product.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: For each type of the following:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of mirror
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- B. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear
 - 1. Nominal Thickness: 6.0 mm
- C. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
 - 3. Finish: Clear bright anodized.

2.5 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Laminated Glazing Reference Manual", "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with sound mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
 - 2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 8300

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.
4. Sound Isolation Clips

B. Related Requirements:

1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For **steel studs and runners** and **firestop tracks**, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 STRUCTURAL COORDINATION

- A. VERIFY ALL INFORMATION WITH STRUCTURAL PLANS AND SPECIFICATIONS.
ALL PRODUCT INFORMATION IN THIS SECTION IS SUPERCEDED BY THE
STRUCTURAL PLANS AND SPECIFICATIONS.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

2.3 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
- B. Studs and Runners: ASTM C 645
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: **0.0329 inch.**
 - b. Depth: As required by designer.
- C. Slip-Type Head Joints:
 - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing **1-1/2-inch** minimum vertical movement.
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: As required by designer
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: **1-1/2 inches**
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: **0.0329 inch.**
 - 2. Depth: **7/8 inch** and **1-1/2 inches.**
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: **3/4 inch**
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, **1 by 3/16 inch by length indicated.**
- D. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: **0.0329 inch.**
 - b. Depth: **As required by designer**
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: **0.0329 inch**
- E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 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 Ceiling and Wall
 - b. Regupol Americal, LLOC
 - c. Rockfon
 - d. USG Corporaion

2.5 SOUND ISOLATION CLIPS

- A. Sound isolation clips specified shall be designed and manufactured by Kinetics Noise Control, Dublin, Ohio. Product shall be Model Iso-Max Sound Isolation Clips.
- B. Vertical Load capacity. Clips shall have sufficient capacity to support wall or ceiling weights as constructed. In a vertical load test comparable to a ceiling installation, the clip shall have a minimum design load capacity of 36 lbs. using 25 gauge furring channel. The minimum design load capacity when using 22 gauge furring channel shall be 48 lbs. Design Load capacity shall be based on a safety factor where the load to failure, defined as pullout of the channel from the clip, is a minimum 2.5 times the allowable maximum Design Load. Anchors for attachment of the clips to the substructure shall be selected to support wall and/or ceiling weights at each clip.

- C. The isolation clips shall consist of a rubber element into which a standard galvanized steel furring channel, 7/8 in. x minimum 25 gauge, is captured. The channel legs snap fit into the rubber element without any metal-to-metal or other rigid contact with building elements.
- D. The isolation clip is attached to the wall/ceiling framing or other structural substrate through galvanized steel brackets on each side of the rubber isolation element. The brackets shall be of sufficient strength to carry the wall or ceiling weight without bending or failure.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide **one of** the following:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: **16 inches o.c.** unless otherwise indicated.
 - 2. Multilayer Application: **16 inches o.c.**
 - 3. Tile Backing Panels: **16 inches o.c.** unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: **48 inches** o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure 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 suspension system.
 - a. 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 locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within **performance limits established by referenced installation standards.**
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems **with hangers used for support**.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within **1/8 inch in 12 feet** measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.6 INSTALLING SOUND ISOLATION CLIPS

- A. General – Install work in accordance with the manufacturer's approved product installation procedures.
- B. Spacing and location of sound isolation clips shall be determined by the manufacturer based on wall or ceiling type. Installation drawing details shall be provided by the manufacturer to assure optimum sound control and structural integrity of the system.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Texture finishes.
4. Sound attenuation blankets.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
3. Section 09 3013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: **Tapered**
- B. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 - 1. For purposes of establishing minimum performance standards, this specification is based on the following: Georgia-Pacific Gypsum LLC, DensArmor Plus Interior Panel
 - 2. Core: **5/8 inch, Type X.**
 - 3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds **Level 2** requirements.
 - 4. Indentation: ASTM C 1629/C 1629M, meets or exceeds **Level 1** requirements.
 - 5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds **Level 3** requirements.
 - 6. Long Edges: Tapered.
 - 7. 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. Core: **5/8 inch, Type X.**
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 4. Location: Wet locations including toilet rooms, drinking fountains, kitchens, sinks and other plumbing fixtures.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: **Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.**

2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.-**Vinyl**
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
3. All corners and exposed edges are to be finished with trim.

B. Exterior Trim: ASTM C 1047.

1. Material: **Hot-dip galvanized-steel sheet, plastic, or rolled zinc.**
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use **setting-type taping** compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use **setting-type, sandable topping** compound.
4. Finish Coat: For third coat, use **setting-type, sandable topping** compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- E. Thermal Insulation: As specified in Section 07 2100 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 07 2600 "Vapor Retarders."

2.7 FINISHES

- A. Primer: As recommended by textured finish manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.

- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, **rounded or beveled edges**, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: **Panels that are substrate for tile.**
 - 3. Level 3: Not used.
 - 4. Level 4: **At panel surfaces that will be exposed to view unless otherwise indicated.**
 - 5. Level 5: **Aqua Room, Littlefield Room, Lobby, Reception, Engineering Lobby, Coho Room.**

3.5 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

END OF SECTION 09 2900

SECTION 09 3013 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic Glazed tile.
2. Porcelain tile.
3. Glazed wall tile.
4. Tile backing panels.
5. Waterproof membrane for thinset applications.
6. Crack isolation membrane.
7. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch lengths.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 2. Obtain waterproof membrane except for sheet products, from manufacturer of setting and grouting materials.

- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

- 1. Metal edge strips.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

- A. Tile Type T-1: Volume 1.0 Glazed Porcelain Tile
 - 1. Manufacturer: Dal Tile
 - 2. Size: 12 by 24 inches
 - 3. Tile Color and Pattern: VL73, Stereo Gray, running bond
 - 4. Grout Color: GR-1 per plans, Ardex Silver Shimmer
- B. Tile Type T-2: Keystones- Colorbody Porcelain Mosaic Tile
 - 1. Manufacturer: Dal Tile
 - 2. Size: 1 by 1 inch, sheets
 - 3. Tile Color and Pattern: DK16, Black/White
 - 4. Grout Color: GR-2 per plans, Ardex Black Licorice
- C. Tile Type T-3: Classic- Color Wheel Collection Glazed Ceramic Tile
 - 1. Manufacturer: Dal Tile
 - 2. Size: 3 by 6 inches
 - 3. Tile Color and Pattern: 0190, Arctic White, 1/3 Offset Pattern
 - 4. Grout Color: GR-3 per plans, Ardex Brilliant White
- D. Tile Type T-4: Artezen Glazed Ceramic Tile

1. Manufacturer: Marazzi
2. Size: 2 by 5 inches, sheets
3. Tile Color and Pattern: AT24, Deep Blue, Picket Mosaic
4. Grout Color: GR-4 per plans, Ardex Azure Blue

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
- B. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

2.6 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.7 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.8 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
- B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 1. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.1.
- C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 1. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.

3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.4.
- D. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
1. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
 3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.15.
- E. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset): ANSI A118.11.
1. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
- F. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
- G. Organic Adhesive: ANSI A136.1, Type I.

2.9 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for

straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Ceramic Glazed Tile: 1/16 inch
 - 2. Glazed Wall Tile: 1/16 inch
 - 3. Porcelain Tile: 1/8 inch
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile
- K. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Install per manufacturer's recommendation for subfloor conditions.

2. Ceramic Tile Installation: TCNA F113; thinset mortar.
 - a. Ceramic Tile Type:
 - b. Thinset Mortar: Standard dry-set, Modified dry-set or Medium-bed, modified dry-set mortar.
 - c. Grout: Sand-portland cement, Standard sanded cement, Standard unsanded cement, High-performance sanded, High-performance unsanded or Water-cleanable epoxy grout.
- B. Interior Wall Installations, Wood or Metal Studs or Furring:
 1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board over vapor-retarder membrane.
 - a. Ceramic Tile Type:
 - b. Thinset Mortar: Standard dry-set, Modified dry-set, Improved modified dry-set mortar.
 - c. Grout: Sand-portland cement, Standard sanded cement, Standard unsanded cement, High-performance sanded, High-performance unsanded, or Water-cleanable epoxy grout.
- C. Bathtub/Shower Wall Installations, Wood or Metal Studs or Furring:
 1. Ceramic Tile Installation: TCNA B412; thinset mortar, organic adhesive, water-cleanable, tile-setting epoxy on cementitious backer units or fiber-cement backer board.
 - a. Ceramic Tile Type:
 - b. Thinset Mortar: Standard dry-set, Modified dry-set, Improved modified dry-set mortar.
 - c. Grout: Sand-portland cement, Standard sanded cement, Standard unsanded cement, High-performance sanded, High-performance unsanded, or Water-cleanable epoxy grout.

END OF SECTION 09 3013

SECTION 09 5123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles for interior ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
- B. Product Test Reports.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:
 - 1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.
 - 2. Directly Attached Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile from single source from single manufacturer.
- B. For purposes of establishing minimum performance standards, this specification is based on the following: Armstrong Ceilings
- C. 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
 - b. CertainTeed
 - c. USG
 - d. Roxul Rockfon

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL TILES: ACT-1

- A. Manufacturer: CertainTeed
- B. Product: Symphony

- C. Color: White
- D. Noise Reduction Coefficient (NRC): .75 Minimum
- E. Finish: Smooth. No visible pocketing or fissures.
- F. Edge/Joint Detail: Reveal/Tegular
- G. Thickness: 3/4" Minimum
- H. Modular Size: 24 by 24 inches as indicated in drawings
- I. Grid System: 15/16" Suspension Grid, White

2.4 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M.
- B. Color: White

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Hold Down Clips: Manufacturer's standard hold down.
- C. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and concealed joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. Install acoustical tile ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- B. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches ends. Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Arrange directionally patterned acoustical tiles as follows:
 - 1. Install tiles with pattern running in one direction as indicated on drawings.
- F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
 - 1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: If needed, Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

3.4 ADJUSTING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5123

SECTION 09 5423 - LINEAR METAL CEILINGS

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 strip, linear metal pans and suspension systems for ceilings.

1.3 DEFINITIONS

- A. LR: Light Reflectance coefficient.
- B. NRC: Noise Reduction Coefficient.

1.4 COORDINATION

- A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:
 - 1. Suspension System Members: 12-inch- long Sample of each type.
 - 2. Exposed Molding and Trim: Set of 12-inch- long Samples of each type, finish, and color.
 - 3. Filler Strips: Set of 12-inch- long Samples of each type, finish, and color.
 - 4. Sound Absorber: 12 inches long.
 - 5. End Cap: Full size.
- C. Delegated-Design Submittal: For design of **seismic restraints and** attachment devices.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Linear pattern.
 - 2. Joint pattern.
 - 3. Ceiling suspension members.
 - 4. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 - 6. Ceiling perimeter and penetrations through ceiling; trim and moldings.
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each linear metal ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For linear metal ceiling and components **and anchor and fastener type**.
- E. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Linear Metal Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to **2** percent of quantity installed.

1.10 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by National Voluntary Laboratory Accreditation Program for testing indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.12 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use

1.13 WARRANTY

- A. Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.
- B. This warranty shall remain in effect for a minimum period of one (1) year from date of initial acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design **seismic restraints and** attachment devices.
- B. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling pans; or permanent damage to fasteners and anchors:
 - 1. Wind Load: Uniform pressure **as indicated on Drawings**, acting inward or outward.
 - 2. Seismic Criteria: Provide linear metal ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580/E 580M.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."

- c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
 - d. ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
- 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces
- D. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- 1. Flame-Spread Index: Comply with ASTM E 1264.

2.2 LINEAR METAL CEILINGS

- A. Manufacturer
- 1. Basis of Design is Certainteed.
- B. Exterior, MTL-3
- 1. Product: Box 6,
 - a. Roll formed,
 - b. Panel Thickness: **.032"** thick aluminum with square edges;
 - c. Panel Width: 5-5/32" wide, 5/8" deep with 27/32" reveal to form a 6" module.
Install 4" and/or 2" panels as needed at ends to maximize coverage of area.
 - d. Panel Length: 12' for Lobby and above Dais. 7' for rest of Aqua Room.
 - e. Closure: No Closure
 - f. Perforations: #160
 - g. Panel Finish:
 - 1) Decorated Wood-Look Powder Coat
 - 2) 8481 Penshaw Cherry
 - h. Trim: Wall Angle Trim
- C. Interior, MTL-8
- a. Roll formed,
 - b. Panel Thickness: **.025"** thick aluminum with square edges;
 - c. Panel Width: 5-5/32" wide, 5/8" deep with 27/32" reveal to form a 6" module.
Install 4" and/or 2" panels as needed at ends to maximize coverage of area.
 - d. Panel Length: 12'
 - e. Closure: Flat Recessed Closure: 5/8" wide roll-formed aluminum hat-shaped closure panel to snap-fit between ceiling panels.
 - 1) Finish: Black
 - f. Perforations: Non-Perforated
 - g. Panel Finish:
 - 1) Decorated Wood-Look Powder Coat
 - 2) 8481 Penshaw Cherry
 - h. Trim:
 - 1) Lobby and above Dais: Wall Angle Trim

2) Aqua Room: End caps matching panel color.

D. Linear Suspension System:

- a. Carrier: Universal hat-shaped, .038" roll-formed aluminum section with hook-shaped tabs spaced to receive ceiling panels at 2" on-center and 27/32" apart. Support holes spaced 4" on-center. Finish: Factory-applied black enamel.
- b. Hanger Wire: 12 gage galvanized carbon steel hanger wire.
- c. Seismic/Wind Uplift Compression Struts: 1-1/2" deep, 16 Ga., cold-rolled steel "C" channels.

E. ACCESSORY MATERIALS

1. Panel End Caps: Formed, stamped, or milled end caps with matching finish.
2. Panel Splice: Formed aluminum insert designed to snap-fit between ends of two ceiling panels.
 - a. Finish: To match panel
3. Access Door: 2' x 2' aluminum access frame with hinges and retainer clip for downward-acting access panel to plenum space.
4. Acoustic Material – Interior only: Non-woven black fabric with 1" thick glass fiber, 1-1/2 pcf density, polywrapped.
 - a. NRC Rating: (.65)(.75)(.95)

2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

2.4 ALUMINUM FINISHES

- A. Mill Finish: AA-M10C10.
- B. Lacquered Mill Finish: AA-M10C10R1x with manufacturer's standard clear, organic coating.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- D. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
- E. Color-Coated Finish: Manufacturer's standard **powder-coat** baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

- F. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with **AAMA 2604** and containing not less than **50** percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- G. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical, bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

2.5 GALVANIZED-STEEL SHEET FINISHES

- A. Color-Coated Finish: Manufacturer's standard **powder-coat** baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

2.6 STEEL SHEET FINISHES

- A. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
- B. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical, bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

2.7 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with

requirements for installation tolerances and other conditions affecting performance of linear metal ceilings.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of linear metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and on Coordination Drawings.

3.3 INSTALLATION

- A. Comply with ASTM C 636/C 636M and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that does not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- G. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
 - 1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 - 2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 - 3. Install pans with butt joints using internal pan splices and in the following joint configuration:
 - a. Aligned.
 - b. Aligned, every other pan length.
 - c. Staggered a minimum of 12 inches.
 - d. Random.
 - e. As indicated.
 - 4. Install directionally textured metal pans in directions indicated.
 - 5. Where metal pan ends are visible, install end caps unless trim is indicated.
 - 6. Install filler strips where indicated.
 - 7. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.
- H. Install hold-down clips where indicated.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: **Owner will engage** a qualified special inspector to perform the following special inspections:
 - 1. Suspended ceiling system.

2. Hangers, anchors, and fasteners.

- B. Testing Agency: **Owner will engage** a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections: Testing and inspecting of completed installations of linear metal ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of linear metal ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
- a. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select 1 of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
- b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Linear metal ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 5423

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.
 - 2. Resilient stair accessories.
 - 3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 WALL BASE WB-1

- A. Manufacturer: Johnsonite
- B. Product: Millwork- Reveal MW-XX-F
- C. Thickness: 1/4 inch
- D. Height: 4.25 inches
- E. Lengths: 8ft sections
- F. Outside Corners: Job formed or preformed
- G. Inside Corners: Job formed or preformed
- H. Colors: Burnt Umber 63

2.2 WALL BASE WB-2

- A. Manufacturer: Johnsonite
- B. Product: Duracove

- C. Thickness: 1/8 inch
- D. Height: 4 inches
- E. Lengths: Coils in manufacturer's standard length
- F. Outside Corners: Job formed or preformed
- G. Inside Corners: Job formed or preformed
- H. Colors: Burnt Umber 63

2.3 STAIR STRINGER, WB-3

- A. Product: Millwork- Reveal MW-XX-F8
- B. Thickness: 1/4 inch
- C. Height: 8 inches
- D. Lengths: 8ft sections
- E. Outside Corners: Job formed or preformed
- F. Inside Corners: Job formed or preformed
- G. Colors: Burnt Umber 63

2.4 RUBBER STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft.** in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum **75** percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than **3 inches** in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than **3 inches** in length.
 - a. **Miter** corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.

3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum horizontal surfaces thoroughly.
 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 1. Apply **two** coat.
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples: For each color and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.4 WARRANTY

- A. Manufacturer's standard warranties

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Vinyl Tile: Full-sized tiles equal to 5 percent of amount installed for each type indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE - LVT-1

- A. Manufacturer: Armstrong Flooring
- B. Product: Natural Creations
- C. Color: Braco Plaster - NA33
- D. Installation: Running bond.
- E. Primary Backing/Backcoating: Manufacturer's standard composite materials
- F. Size: 12" x 24"
- G. Applied Treatments:
 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products if recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after reviewing results with Architect.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern

between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish, if recommended by manufacturer.
- C. Cover floor tile until Substantial Completion.

END OF SECTION 09 6519

SECTION 09 6536 - STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Static-dissipative, **vinyl composition floor tile**.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of static-control resilient flooring.

1. Samples: For each type of static-control resilient flooring.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive static-control resilient flooring.

1. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

- B. Close spaces to traffic during static-control resilient flooring installation.

- C. Close spaces to traffic for 48 hours after static-control resilient flooring installation.

- D. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
 - 1. Electrical Resistance: Test per **ASTM F 150 with 100-V applied voltage** and **ESD-STM-7.1**.
 - a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
 - b. Average greater than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.
 - 2. Static Generation: Less than **300 V** when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
 - 3. Static Decay: 5000 to zero V in less than **0.25** seconds when tested per FED-STD-101C/4046.1.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS

- A. Static-Dissipative, Vinyl Composition Floor Tile, **ED-1**: ASTM F 1066 (vinyl composition floor tile, nonasbestos formulated), Class 2 (through-pattern tile).
 - 1. **Manufacturer: Armstrong**
 - 2. **Product: Excelon STD**
 - 3. **Thickness: Not less than 0.125 inch.**
 - 4. **Size: 12 by 12 inches.**
 - 5. **Color: 51959 - Coal.**

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.

- C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.
- D. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor-covering manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions **and with oversight by manufacturer's representative** to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.
- B. Concrete Substrates: Prepare according to ASTM F 710 and as recommended by manufacturer. Do not use solvents for cleaning substrates.
- C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- D. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.
 - 1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.2 INSTALLATION, GENERAL

- A. Install static-control resilient flooring according to manufacturer's written instructions.
- B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.
- C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Adhere static-control resilient flooring to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 FLOOR-TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
 - 1. Lay floor tiles **square with room axis**.
- C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
 - 1. Lay static-dissipative, vinyl composition floor tiles **with grain running in one direction**.

3.4 SHEET FLOOR-COVERING INSTALLATION

- A. Comply with manufacturer's written instructions for installing sheet floor coverings.
- B. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.
- C. Lay out sheet floor coverings as follows:
 - 1. Maintain uniformity of sheet floor-covering direction.
 - 2. Minimize number of seams and place them in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor-covering substrates.
 - 3. Match edges of floor coverings for color shading at seams.
 - 4. Avoid cross seams.

3.5 FIELD QUALITY CONTROL

- A. Testing: **Engage** a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.
 - 1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.
 - 2. Arrange for testing of static-control resilient flooring **after** performing floor polish procedures.
- B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.
- B. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- C. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION 09 6536

SECTION 09 6813 - TILE CARPETING

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 modular carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports.
- B. Sample Warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.9 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. CPT-1
1. Manufacturer: INTERFACE FLOORING
 2. Product: MOSS 1286102500
 3. Color: GRANITE 105560
 4. Installation: NON DIRECTIONAL- PER PLANS
 5. Primary Backing/Backcoating: Manufacturer's standard composite materials
 6. Secondary Backing: Manufacturer's standard material
 7. Size: 19.69" X 19.69"
- B. CPT-2
1. Manufacturer: INTERFACE FLOORING
 2. Product: MOSS IN STONE 1286202500
 3. Color: GRANITE EDGE 105564
 4. Installation: NON DIRECTIONAL- PER PLANS
 5. Primary Backing/Backcoating: Manufacturer's standard composite materials
 6. Secondary Backing: Manufacturer's standard material
 7. Size: 19.69" X 19.69"
- C. CPT-3
1. Manufacturer: INTERFACE FLOORING
 2. Product: SETT IN STONE 1286302500
 3. Color: GRANITE 105568
 4. Installation: NON DIRECTIONAL- PER PLANS
 5. Primary Backing/Backcoating: Manufacturer's standard composite materials
 6. Secondary Backing: Manufacturer's standard material
 7. Size: 19.69" X 19.69"

D. CPT-4

1. Manufacturer: INTERFACE FLOORING
2. Product: KERBSTONE 1286402500
3. Color: GRANITE 105572
4. Installation: NON DIRECTIONAL- PER PLANS
5. Primary Backing/Backcoating: Manufacturer's standard composite materials
6. Secondary Backing: Manufacturer's standard material
7. Size: 19.69" X 19.69"

E. CPT-5

1. Manufacturer: INTERFACE FLOORING
2. Product: FLAGSTONE 1286502500
3. Color: GRANITE 105576
4. Installation: NON DIRECTIONAL- PER PLANS
5. Primary Backing/Backcoating: Manufacturer's standard composite materials
6. Secondary Backing: Manufacturer's standard material
7. Size: 19.69" X 19.69"

F. CPT-6

1. Manufacturer: INTERFACE FLOORING
2. Product: FLAGSTONE 1286502500
3. Color: SLATE 105577
4. Installation: NON DIRECTIONAL- PER PLANS
5. Primary Backing/Backcoating: Manufacturer's standard composite materials
6. Secondary Backing: Manufacturer's standard material
7. Size: 19.69" X 19.69"

G. CPT-7

1. Manufacturer: INTERFACE FLOORING
2. Product: FLAGSTONE 1286502500
3. Color: FLINT 105578
4. Installation: NON DIRECTIONAL- PER PLANS
5. Primary Backing/Backcoating: Manufacturer's standard composite materials
6. Secondary Backing: Manufacturer's standard material
7. Size: 19.69" X 19.69"

H. CPT-8

1. Manufacturer: INTERFACE FLOORING
2. Product: FLAGSTONE 1286502500
3. Color: ONYX 105579
4. Installation: NON DIRECTIONAL- PER PLANS
5. Primary Backing/Backcoating: Manufacturer's standard composite materials
6. Secondary Backing: Manufacturer's standard material
7. Size: 19.69" X 19.69"

2.2 Applied Treatments:

- A. Soil-Resistance Treatment: Manufacturer's standard treatment
- B. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

1. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
 1. Manufacturer Recommended Adhesives:
 - a. Commercialon® Premium Adhesive, a premium modular flooring adhesive specifically formulated for bonding EF Contract Flooring Nexus® Modular PVC backed carpet to the floor.
- C. Metal Edge/Transition Strips: Extruded aluminum with Satin Anodized Aluminum finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- B. Metal Subfloors: Verify the following:
 1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern per the drawings

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

SECTION 09 7700 - FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
 - a. PVC trim

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Samples: For each type of product, at least 6"x 6" in size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:

1. ASTM 84 (Method of test for surface burning characteristics of building Materials)

B. Sanitary Standards: System components and finishes to comply with:

1. United States Department of Agriculture (USDA) / Food Safety & Inspection Services (FSIS) requirements for food preparation facilities, incidental contact.
2. Food and Drug Administration (FDA) 2013 Food Code 6-101.11.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packages on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (range of 60° to 75°) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Building is to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work.
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

- 1. Furnish one-year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers
 - 1. Marlite
 - 2. Eplastics
 - 3. Arrow Manufacturing
 - 4. McNichols Co.
 - 5. Crane Composites
 - 6. Kal-Lite
- B. Product (basis of design):
 - 1. Marlite: Standard FRP S100 S2S White

2.2 PANELS

- 1. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319
 - a. Dimensions:
 - 1) Thickness: 0.090" nominal
 - 2) Width: 4'-0" nominal
 - 3) Length: As indicated in drawings
 - b. Tolerance:
 - 1) Length and width: +/- 1/8"
 - 2) Square: Not to exceed 1/8" for 8 foot panels or 5/32" for 10 foot panels.
 - c. Properties, resistant to rot, corrosion, staining, denting, peeling, and splintering:
 - 1) Flexural Strength: 1.7×10^4 psi per ASTM D 790
 - 2) Flexural Modulus: 6.0×10^5 psi per ASTM D 790
 - 3) Tensile Strength: 8.0×10^3 psi per ASTM D 638
 - 4) Tensile Modulus: 9.43×10^5 psi per ASTM D 638
 - 5) Water Absorption: 0.17% per ASTM D 638
 - 6) Barcol Hardness (scratch resistance) of 30 as per ASTM D 2583

- 7) Izod Impact Strength of 7.0 ft. lbd./in ASTM D 256
- d. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- e. Front Finish: As indicated in drawings

2.3 MOLDINGS

- A. PVC Trim: Thin-wall semi-rigid extruded PVC.
 - 1. M 350 Inside Corner
 - 2. M360 Outside Corner
 - 3. M365 Division
 - 4. M370 Edge
 - 5. V 177 135° Inside Corner
 - 6. V 179 135° Outside Corner
 - 7. Color: White

2.4 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
 - 1. Match panel colors.
 - 2. Length to suit project conditions.
- B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
 - 1. Marlite C-551 FRP Adhesive – Water – resistant, non-flammable adhesive.
 - 2. Marlite C-915 Construction Adhesive – Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
 - 3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.
- C. Sealant:
 - 1. Marlite Brand MS-250 Clear Silicone Sealant.
 - 2. Marlite Brand MS-251 White Silicone Sealant.

PART 3 - EXECUTION

2.5 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
 - 1. Verify that stud spacing does not exceed 24” on center.
- B. Repair defects prior to installation.
 - 1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

2.6 INSTALLATION

- A. Comply with manufacturer's recommended procedures and installation sequence.
- B. Cut sheets to meet supports allowing 1/8" clearance for every 8 foot pf panel.
- C. Pre-drill fastener holes 1/8" oversize with high speed drill bit.
 - 1. Space at 8" maximum on center at perimeter, approximately 1" from panel edge.
 - 2. Space in field in rows 16' on center, with fasteners spaced at 12" maximum on center.
- D. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
 - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.
- E. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8" of panel expansion at joints and edges, to ensure proper installation.
 - 2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

2.7 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- B. Refer to manufacturer's specific cleaning recommendations. Do not use abrasive cleaners.

END OF SECTION 09 7700

SECTION 09 8433 - SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing wall panels.
- B. Related Requirements:

1.3 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include **fabric facing**, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
- C. Samples for Verification: For the following products:

1. Panels: Full-width by approximately 12-inch long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Mounting Devices: Full-size Samples.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Electrical outlets, switches, and thermostats.
- B. Product Certificates: For each type of unit.
- C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Panel: For each fabric, color, and pattern installed, provide length equal to **10** percent of amount installed, but no fewer than (1) full piece, full width of bolt.
 2. Mounting Devices: Full-size units and no fewer than **five** devices, including unopened adhesives.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- C. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.
 - b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.
 - 2. Warranty Period: **Two** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

- A. **Sound-Absorbing Wall Panel, AP-1, AP-2 & AP-3:**
 - 1. **Manufacturer: Basis of Design is Turf Design**
 - 2. **Product: Plank carved wall tile**
 - 3. **Panel Shape: Flat, rectangular.**
 - 4. **Color: As indicated in Drawings**
 - 5. **Heights: 3", 4 1/2" and 6" as indicated in Drawings**
 - 6. **Length: 11 3/4", 23 1/2" and 47" as indicated in Drawings.**
 - 7. **Thickness: Manufacturer's standard, 9mm.**
 - 8. **Mounting: Concealed back mounted with manufacturer's standard, secured to substrate.**
 - 9. **Core: Manufacturer's standard**
 - 10. **Edge Construction: Manufacturer's standard**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain **as indicated on Drawings**.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation of Joint Width: Not more than 1/32-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8433

SECTION 09 9113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Section 09 9123 – Interior Painting
 - 2. Section 09 9600 – High Performance Coatings
- C. DEFINITIONS
- D. Flat refers to a low luster or matter finish with a gloss range below 15 when measured at an 85-degree meter.
- E. Eggshell and Satin refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
- F. Semi-gloss refers to low-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
- G. Full gloss or High Gloss, refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in its “MPI Approved Products List”
 - 2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting Specification Manual” for products and finish systems indicated.
- B. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.
- C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Protect from freezing. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers:

1. Sherwin Williams Co.
2. PPG
3. Tnemec
4. Benjamin Moore & Co.
5. Kelly-Moore Paints
6. PPG Architectural Finishes, Inc.
7. Rodda Paint Company
8. ICI Dulux Paint Centers
9. Valspar Corporations, McCloskey
10. Master Coating Technologies

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufactures product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide colors listed in drawings or approved comparable product.

1. Ten percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from

previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Portland Cement Plaster: 12 percent.
 - 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
 - 7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - f. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. General: Work specified herein is in ADDITION to shop coats called for under other Sections. Products listed in the following schedule are generally those of "Sherwin-Williams" to establish the type and level of quality and paint type required. Also see article 2.1.C. All paint systems must conform to the MPI manual. If a paint system herein does not comply with the MPI, contact the Architect for clarification.

B. Hollow Metal Doors & Door Frames:

1. Surfaces to be Painted: Include exposed surfaces - both faces, ends, edges and stops (all sides) of all exterior hollow metal doors and exposed frame surfaces. Coordinate with Section 08800 to glaze after painting.
2. Manufacturer: PPG, or equivalent high performance coating from TNEMEC or approved substitute during the bid process per specification Sections 00100 and 01631.
3. Field Prime Coat: "PPG Durethane D-T-M Mastic 95-3300 series", 3 to 4 mils dry film thickness, or, S-W Pro Cry Universal Primer B66W310 4-5 mildsd. Apply to all exposed surfaces.
4. Field Finish Coat: "PPG Durethane D-T-M Mastic 95-3300 series", 3 to 4 mils dry film thickness, or, S-W Sher Cryl HPA Acrylic B66-300 series, (2.5 to 4.0 mils dry per coat), at 2 dft/ct. Apply to all exposed surfaces.

C. Exterior Exposed Steel and Railings: See Division 9 Section "High Performance Coatings".

D. Mechanical, Electrical and Utility Equipment

1. General: Work in this paragraph includes all exposed mechanical, electrical, and utility equipment including, but not necessarily limited to, rooftop mechanical equipment, plastic gas vents, aluminum exhaust vents, rooftop pipe penetrations, exhaust fan hoods and the like.
2. Prime Coat, Galvanized Steel: Sherwin-Williams Pro Cryl Universal Acrylic Primer B66-310 Series (2.0 - 4.0 mils dry per coat), @ 3-4 DFT/ct.
3. Prime Coat, Ferrous Metal: Sherwin-Williams Pro Cryl Universal Acrylic Primer B66-310 Series (2.0 - 4.0 mils dry per coat), B50Z Series.
4. Finish Coats: Apply two coats "Sherwin Williams" Sher-Cryl™ HPA Acrylic B66-300 Series (2.5 - 4.0 mils dry per coat), @ 2 DFT/ct.

END OF SECTION 09 9113

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 09 9113 – Exterior Painting
 - 2. Section 09 9600 – High Performance Coatings

1.2 DEFINITIONS

- A. Flat refers to a low luster or matter finish with a gloss range below 15 when measured at an 85-degree meter.
- B. Eggshell and Satin refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
- C. Semi-gloss refers to low-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
- D. Full gloss or High Gloss, refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal of each material and color applied.

1.5 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in its “MPI Approved Products List”
 - 2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting Specification Manual” for products and finish systems indicated.
- B. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.
- C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer’s original, unopened packages and containers bearing manufacturer’s name and label.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers:
 - 1. Sherwin Williams Co.
 - 2. PPG
 - 3. Tnemec
 - 4. Benjamin Moore & Co.
 - 5. Kelly-Moore Paints
 - 6. Rodda Paint Company
 - 7. ICI Dulux Paint Centers
 - 8. Valspar Corporations, McCloskey
 - 9. Master Coating Technologies

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufactures product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide colors listed in drawings or approved comparable product.
 - 1. Twenty percent of surface area will be painted with deep tones.
- D. VOC Content of Field-Applied Interior Paints and Coatings and Interior Primers: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - 3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 4. Floor Coatings: VOC not more than 100 g/L.

5. Shellacs, Clear: VOC not more than 730 g/L.
 6. Shellacs, Pigmented: VOC not more than 550 g/L.
 7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 9. Clear Wood Finishes, Varnishes: VOC content not more than 350 g/L.
 10. Clear Wood Finishes, Lacquers: VOC content not more than 550 g/L.
 11. Stains: VOC content not more than 250 g/L.
 12. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 13. Floor Coatings: VOC not more than 100 g/L.
 14. Shellacs, Clear: VOC not more than 730 g/L.
 15. Shellacs, Pigmented: VOC not more than 550 g/L.
 16. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 17. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 18. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 19. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
- E. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.

- y. Vinyl chloride.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Gypsum Board: 12 percent.
 - 6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 - 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 - 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 - 4. Allow sufficient time between successive coats to permit proper drying.
- F. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

- G. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- H. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.
- I. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Uninsulated metal piping.
 - 2. Uninsulated plastic piping.
 - 3. Pipe hangers and supports.
 - 4. Tanks that do not have factory-applied final finishes.
 - 5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 - 7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- J. Electrical items to be painted include, but are not limited to, the following:
 - 1. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. Touch up paint for pre-finished electrical equipment/devices.
 - 3. As needed for emergency system and life safety provision.
- K. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- L. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, luster, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. General
 - 1. Work specified herein is in ADDITION to shop coats called for under various other Divisions and Sections.
 - 2. Unless otherwise specifically noted on Drawings, or set forth hereinafter, all interior surfaces shall be painted, or enameled and/or finished in accordance with the number and type of coats as hereinafter specified.
 - 3. Products listed in the following schedule are generally those of Sherwin-Williams to establish the type and level of quality required. Equivalent products by other approved manufacturers will also be accepted.
 - 4. Existing surfaces scheduled to be refinished . Omit specified primer unless required by patching or to cover stains, and provide finish coats as specified for new work, unless specifically scheduled otherwise.
- B. Metal Substrates: Latex Galvanized-metal substrates should not be chromate passivated if primers are field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate primers.
 - 1. Doors and Door Framing
 - a. Prime Coat: Primer, rust-inhibitive, water based.
 - 1) SW Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
 - b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based acrylic, semi-gloss:
 - 1) SW Pro Industrial Acrylic Semi-Gloss Coating
 - 2. Structural Elements/Framing per drawings:
 - a. Prime Coat: Primer, rust-inhibitive, water based.
 - 1) Manufacturer's Standard Shop Primer
 - 2) SW Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
 - b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based acrylic, egg-shell:
 - 1) SW Pro Industrial Acrylic Egg-Shell Coating
- C. Interior Exposed Steel: See Division 9 Section "High Performance Coatings".

- D. Hollow Metal Doors and Frames: See Division 9 Section “Exterior Painting”
- E. Wood Substrates:
1. Architectural woodwork, half wall top caps.
 - a. Prime Coat: Primer sealer, latex, interior:
 - 1) SW PrepRite ProBlock Primer Sealer, B51-620 Series
 - b. Intermediate Coat: Latex, interior, matching topcoat:
 - c. Top Coat: Latex, interior, egg-shell
 - 1) SW ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
- F. Gypsum Board Substrates:
1. Latex System
 - a. Prime Coat: Primer, latex, interior
 - 1) SW ProMar 200 Zero VOC Latex Primer, B28W2600
 - b. Intermediate Coat: Latex, interior matching topcoat.
 - c. Top Coat: Latex, interior, flat
 - 1) SW ProMar 200 Zero VOC Latex Flat, B30-2600 Series
 - d. Top Coat: Latex, interior, egg-shell
 - 1) SW ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
 - e. Top Coat: Latex, interior, semi-gloss
 - 1) SW ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
 2. Wet Area (Shower Ceilings)
 - a. Prime Coat: Primer, latex, interior
 - 1) SW ProMar 200 Zero VOC Latex Primer, B28W2600
 - b. Intermediate Coat: Latex, interior matching topcoat.
 - c. Top Coat: Pre-Catalyzed Waterbased Epoxy Eg-Shell
 - 1) SW Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45-1150 Series
- G. Mechanical Equipment, Grilles & Diffusers
1. Inside ducts just behind grilles and diffusers: Paint to 12 inches back from grilles, one coat dead black flat, same system as specified for interior hollow metal doors.
 2. Exposed Pipes: Paint exposed pipes in occupied and otherwise public areas with finish system as specified herein for Interior Exposed Steel, except no painting required in Mechanical rooms and spaces.
 3. Ducts Exposed in occupied spaces: Paint exposed ducts in occupied and otherwise public areas with finish system as specified herein for Interior Exposed Steel; color as selected. No painting required in Mechanical rooms and spaces.
 4. All other mechanical equipment: Surfaces are factory-finished; no painting or finishing required.
 5. All surfaces above the ceiling in the Aqua Room are to be painted
- H. Electrical Equipment
1. Flush Distribution Panels in Finish-Painted Walls: Paint with same system as specified above for hollow metal doors and frames, of same finish color as adjacent wall.
 2. Surface Mounted Panels: Unless otherwise directed by the Owner, paint with same system as specified above, of same finish color as adjacent wall.
 3. Conduit: No painting required in Electrical, mechanical, and attic rooms and spaces. At all other locations, paint exposed conduit in areas with finish system as specified herein

for Interior Exposed Steel, of same finish color as adjacent wall and/or ceiling, as applicable.

4. All surfaces above the ceiling in the Aqua Room are to be painted.

3.7 INTERIOR STAINING SCHEDULE

A. Interior Wood to be Stained (non-walking surfaces)

1. Fine sand to provide clean smooth base.
2. Apply one coat "Sherwin Williams Wood Classics Interior Oil Stain, A49 Series.
3. Seal with one coat "Sherwin Williams Wood Classics Polyurethane Varnish, Gloss A67V1" series thinned with one pint of mineral spirits per gallon allow to dry for 18 hours, sand smooth remove sanding dust and apply topcoat, gloss finish.
4. Finish with two finish coats of "Sherwin Williams Wood Classics Polyurethane Varnish", Gloss, 4 mils wet, 1.4 mils dry per coat unreduced, spread at a minimum spreading rate of 550 sq. ft. per gallon each coat. Allow 18-24 hours drying time between coats. Finished surface shall have a hand rubbed satin finish to match sheen of factory finished casework.

B. Interior Wood to be Stained (walking surfaces)

1. Fine sand to provide clean smooth base.
2. Apply one coat "Sherwin Williams Wood Classics Interior Oil Stain, A49 Series.
3. Thoroughly wipe floor with a clean cloth dampened with mineral spirits and allow to dry
4. Before use, stir Minwax® Super Fast-Drying Polyurethane for Floors to rotate the product from the bottom to the top of the can.
5. Apply a thin coat and maintain a wet edge to avoid lap marks.
6. Let dry at least 3-4 hours until no longer tacky and can be walked on without damaging finish.
7. Apply a second coat.
8. Apply a third coat if the floor was not a stained or sealed

Note: Sanding is not required between coats. Allow 4-6 hours dry-time and sand with 220-grit sandpaper. Remove all dust. Thoroughly wipe floor with a clean cloth dampened with mineral spirits and allow to dry.

END OF SECTION 09 9123

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

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 surface preparation and field application of high-performance coating systems to items and surfaces scheduled.
- B. Related Requirements:
 - 1. Section 09 9113 – Exterior Painting
 - 2. Section 09 9123 – Interior Painting

1.3 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Gloss ranges used in this Section include the following:
 - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.
- C. Environments: The following terms are used in Part 2 of this Section to distinguish between different corrosive exposures:
 - 1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.
 - 2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.
 - 3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.4 SUBMITTALS

- A. Product Data: For each coating system indicated. Include block fillers and primers.
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.
- B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.
- C. Samples: Samples will not be returned other than copies of approved sample finishes (draw-downs):
 - 1. Color Sample Box: If requested by the Architect, submit one manufacture's color box with the full line of color samples in approximately 4 x 6 inch sample size.
 - 2. Color Wheel: If requested by the Architect, submit one full spectrum color wheel for each of the various coatings involved, for Architect's use for color selections; submit additional color wheels or the like for specialty coatings of other manufactures where different from general paint supplier.
 - 3. Applied Finish Samples: Submit samples in accordance with the following as directed:
 - a. Where requested, and before commencing work, prepare samples on final substrate; size not less than 12" x 12".
 - b. Prepare (4) sets of 8 1/2" x 11" paint sample cards of each color, texture, and sheen.
 - c. Three samples each lumber species, each 2 feet long, for "stain samples."
 - d. Furnish additional required samples until colors, finishes, textures are reviewed and accepted by the Architect (followed by written authorization to proceed).
 - e. Mark on each sample the paint manufacturer's name, color name, and color code formula.
 - f. Allow ample time for the selection of colors; do not work until colors are approved.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance. A qualified foreman will be on site during preparation and painting operations.
- B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
- D. Tape adhesion tests will be per ASTM 3359 Method A X cut. Passing test will be 4 or 5.
- E. See Quality Assurance requirements of Division 9 Section "Painting," which also applies to this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
 - 1. Name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. Handling instructions and precautions.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F.
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
 - 2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

1.8 WARRANTY

- A. Proved as specified in Division 9 Section "Painting" plus any available extended warranties available for High-Performance Coatings specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. PPG has been used in this specification as a basis of design. Equivalent TNEMEC products are also acceptable. Other manufacturers may submit as a substitution as provided under specification sections in Division 01.

2.2 COATINGS MATERIALS, GENERAL

- A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience. Where the factory prime coat is not compatible with the specified primer and/or finish coats, provide a seal coat to make surface ready for specified primer and finish coats.
- B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.

2.3 COLORS

- A. Colors: As selected by Architect from manufacturer's full range, or custom colors where requested by Architect. Also see Color Schedule on drawings.

2.4 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

- A. Hollow Metal Doors and Hollow Metal Frames: See Section 09 9113 – Exterior Painting.
- B. Ferrous Metal
 - 1. Locations: All exterior ferrous metal, including but not limited to (except where indicated on drawings specifically to remain galvanized without a finish):
 - a. Exposed structural steel (of all types).
 - b. Steel railings, except those noted to be powder coated.
 - c. Steel pipe bollards.
 - d. Roof hatches.
 - e. Non-factory finished gate and fence components.
 - f. Exposed metal curbs
 - g. Other miscellaneous exposed steel noted or scheduled to be painted. See Color Schedule on the drawings.

2. Semi-gloss finish: One finish coat over an intermediate coat and a primer, as follows:
 - a. Primer: This coat may be factory applied and touched-up in the field. Coordinate with Division 5 Sections.
 - 1) “PPG Pitt Guard Rapid Coat D-T-R Epoxy Coating 95-245 series”, 5 to 7 mils DFT.
 - b. Intermediate Coat:
 - 1) “PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 series, 2.0 to 5.0 mils DFT.
 - c. Color Coat:
 - 1) “PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 series, 2.0 to 5.0 mils DFT.

C. Nonferrous Metal: Provide the following finish systems over exterior nonferrous-metal surfaces scheduled or noted to be painted:

1. Primer: This coat may be factory applied and touched-up in the field. Coordinate with Division 5 Sections.
 - a. “PPG Pitt Guard Rapid Coat D-T-R Epoxy Coating 95-245 series”, 5 to 7 mils DFT.
2. Intermediate Coat:
 - a. “PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 series, 2.0 to 5.0 mils DFT.
3. Color Coat:
 - a. “PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 series, 2.0 to 5.0 mils DFT.

2.5 INTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Hollow Metal Doors and Hollow Metal Frames: See Section 09 9113 – Exterior Painting.

B. Ferrous Metal

1. Locations: All interior ferrous metal, including but not limited to (do not paint stainless steel unless specifically noted):
 - a. Exposed structural steel (of all types).
 - b. Handrails and guardrails, powder coated.
 - c. Decorative steel
 - d. Steel ladders
 - e. Steel stairs
 - f. Other miscellaneous exposed steel.

2. Finish:

- a. Primer: This coat may be factory applied and touched-up in the field. Coordinate with Division 5 Sections.
 - 1) “PPG Pitt Guard Rapid Coat D-T-R Epoxy Coating 95-245 series”, 5 to 7 mils DFT.
 - b. Intermediate Coat:
 - 1) “PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 series, 2.0 to 5.0 mils DFT.
 - c. Color Coat:
 - 1) “PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 series, 2.0 to 5.0 mils DFT.
- C. Nonferrous Metal: Where scheduled to be painted, provide same as above for ferrous metal. Confirm any special priming requirements with manufacturer and provide.

PART 3 - EXECUTION

3.1 GENERAL

- A. Also comply with the Part 3 requirements of Division 9 sections “Exterior Painting” and “Interior Painting”.

3.2 EXAMINATION

- A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
 - 1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
 - 2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.
- B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
 - 1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.

2. Notify Architect about anticipated problems before using the coatings specified over substrates primed by others.

3.3 PREPARATION

- A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- B. Cleaning: Before applying high-performance coatings, clean substrates per SSPC-SP-3.
 1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
 2. Surface Preparation: Clean and prepare surfaces to be coated with SSPG-SP-1.
 3. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; - per SSPC-SP-6 if not shop blasted.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged., Prepare per SSPC- SP-3 and touch up with same primer as the shop coat.
 4. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required. Prepare per SSPC –SP-3 before priming.
 - a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- C. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
 1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
 3. Use only the type of thinners approved by manufacturer and only within recommended limits.
- D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.4 APPLICATION

- A. General: Apply high-performance coatings according to manufacturer's written instructions.
 1. Use applicators and techniques best suited for the material being applied.

2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
 3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
 4. Provide finish coats compatible with primers used.
 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required is the same regardless of application method.
 - a. Omit primer on metal surfaces that have been shop primed and touchup painted, if specifically allowed herein.
 - b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 - c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
 - d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
 2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated. System used shall be at the Contractor's discretion as necessary to produce the highest quality finish, unless a specific system is specified herein.
 - a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
 - b. Brush out and work brush coats into surfaces in an even film.

- c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
- 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required. Roller covers are not to leave roller fuzz in the finish.
- 3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
 - a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
 - b. Apply each coat to provide the equivalent hiding of brush-applied coats.
 - c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.
- D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others, except as noted below.
 - 1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing, or if specified herein to receive an additional prime coat.
- F. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.5 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
 - 1. Owner may engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:
 - a. Quantitative materials analysis.
 - b. Absorption.
 - c. Accelerated weathering.
 - d. Accelerated yellowness.
 - e. Color retention.
 - f. Alkali and mildew resistance.
 - g. Abrasion resistance.
 - h. Apparent reflectivity.
 - i. Washability.

- j. Dry opacity.
 - k. Recoating.
 - l. Skinning.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

3.6 CLEANING

- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.7 PROTECTION

- A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 09960

SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cutout dimensional characters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights and accessories.
- B. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Dimensional Characters: Full-size Sample of dimensional character with specified finish.
 - 2. Exposed Accessories: Full-size Sample of each accessory type.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cutout Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:
 - 1. Character Material: Aluminum.
 - 2. Character Height: As indicated
 - 3. Thickness: 1".
 - 4. Finishes: Black anodized to match aluminum storefronts.
 - 5. Mounting: Concealed

2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use **flathead or oval countersunk** screws and bolts with tamper-resistant.
 - 3. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 1419

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Toilet room accessories.
 - 2. Shower room accessories.
 - 3. Childcare accessories.
 - 4. Underlavatory guards.
 - 5. Custodial accessories.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Samples: For each finish specified.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: **15** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

- A. **Owner-Furnished Materials: Owner will provide but the contractor will install the following items. All items will be manual or battery powered.**
 - 1. Toilet paper dispensers- recessed**
 - 2. Toilet seat cover dispensers- surface mounted**
 - 3. Paper towel dispensers- recessed**
 - 4. Trash receptacles- recessed**
 - 5. Soap dispensers- surface mounted**
 - 6. Sanitary napkin dispensers- surface mounted**

2.2 PERFORMANCE REQUIREMENTS

- 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.

2.3 TOILET ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Grab Bar GB-1:
 - 1. Basis of Design: Bobrick B-5806.
 - 2. Locations: All toilet rooms and shower.
 - 3. Mounting: Flanges with concealed fasteners.
 - 4. Material: Stainless steel, 0.05 inch thick.

- a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
- 5. Outside Diameter: 1-1/4 inches.
- 6. Configuration and Length: As indicated on Drawings.
- C. Sanitary-Napkin Disposal Unit ND-1:
 - 1. Basis of Design: Bobrick B-270.
 - 2. Count & Location: All women's and unisex toilet rooms.
 - 3. Mounting: Surface mounted.
 - 4. Door or Cover: Self-closing, disposal-opening cover.
 - 5. Receptacle: Removable.
 - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
- D. Mirror Unit MM-1:
 - 1. Locations: All toilet rooms.
 - 2. Frame: Stainless-steel, 0.05 inch thick
 - a. Corners: Manufacturer's standard.
 - 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 unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - 4. Size: As indicated on plans.
- E. Coat Hook:
 - 1. Location: On all doors to toilet rooms.
 - 2. Description: Double-prong unit.
 - 3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.4 SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
- B. Shower Curtain Rod:
 - 1. Location: Shower
 - 2. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch- thick stainless steel.
 - 3. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
 - 4. Finish: Stainless steel, No. 4 finish (satin).

C. Shower Curtain:

1. Location: Shower
2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Nylon-reinforced vinyl, minimum 10 oz. or 0.008-inch- thick vinyl, with integral antibacterial agent.
4. Color: As selected from manufacturer's full range
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat:

1. Location: Shower
2. Configuration: Rectangular seat.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin) .
5. Dimensions: 28"W x 15"D x 1/2" thick

E. Towel Hook:

1. Location: Shower
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.5 CHILDCARE ACCESSORIES

A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.

A. Diaper-Changing Station BC-1:

1. Subject to compliance with requirements, provide products from the following manufacturers.
 - a. Koala Kare
 - b. Bradley
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 200-lb static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color or Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.

2.6 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.7 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Mop and Broom Holder :
 1. Basis of Design: Bobrick B-224 x 36
 2. Count & Locations: (2) total. One in Mechanical Room 131 and one in Jan. 228.
 3. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf
 4. Length: 36 inches.
 5. Hooks: Three.
 6. Mop/Broom Holders: **Four**, spring-loaded, rubber hat, cam type.
 7. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.8 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.9 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories 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, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for Portable fire extinguishers.

B. Related Requirements:

1. Section 10 4416 "Fire Extinguishers."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of **fire extinguishers** indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire **extinguisher**.
- B. Cabinet Material: **Cold-rolled steel sheet**.
- C. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: **2-1/2-inch**.
- D. Cabinet Trim Material: **Same material and finish as door**.
- E. Door Material: **Steel sheet**
- F. Door Style: **Fully glazed panel with frame**.
- G. Door Glazing: **Acrylic sheet**.
 - 1. Acrylic Sheet Color: **Clear** transparent acrylic sheet.
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide **manufacturer's standard hinge** permitting door to open 180 degrees.
- I. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Door Lock: **Cam lock that allows door to be opened during emergency by pulling sharply on door handle**.
- J. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: **Baked enamel or powder coat**.
 - b. Color: **As selected by Owner from full range of industry colors and color densities**.
 - 2. Transparent Acrylic Sheet: manufactures standard sheet meeting ASTM D 4802.

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.

- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated **or, if not indicated, at heights acceptable to authorities having jurisdiction.**
 - 1. Fire-Protection Cabinets: **54 inches** above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

END OF SECTION 10 4413

SECTION 10 4416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 4413 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.5 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. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. 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.
- B. Regular Dry-Chemical Type UL-rated 5 lbs nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10 4416

SECTION 10 5626 - MOBILE STORAGE SHELVING

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. Mechanically operated systems.
 - 2. Steel four-post shelving.

1.3 COORDINATION

- A. Recessed Tracks: Coordinate size and location of recesses in concrete with installation of recessed tracks.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for mobile shelving systems and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Show shelving layout.
 - 3. Show location and extent of rail system **including depth required if recessed.**
 - 4. Show clear-aisle widths from face of carriages.
 - 5. Detail fabrication and installation of mobile shelving systems including methods of anchoring shelves to carriages and rails to building structure **as required for seismic restraint.**
- C. Samples: For each exposed product and for each color and texture specified, **6 inches** in size.
- D. Samples for Verification: For the following products, one of each, **in manufacturer's standard size**:
 - 1. Flat shelving.
 - 2. Each type of specialized shelving.
 - 3. Front panels.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Design Calculations: For seismic design of mobile storage shelving systems including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For Installer.
- C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mobile shelving systems to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Shelf Units: 2 of each size and type indicated.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of mobile shelving systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 2. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: **Datum Filing Systems, Inc.**
 - 1. Other approved manufacturers:
 - a. Spacesaver Corporation
 - b. Borroughs Corporation
 - c. Tab Products Co

d. Aurora Storage Products

- B. Source Limitations: Obtain mobile storage systems including shelving from single manufacturer.
- C. Product: Basis of Design: **MobileTrak 5**

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Mobile shelving systems shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
- B. Structural Performance: Provide mobile shelving systems capable of supporting the following:
 - 1. Load per Linear Foot of Carriage: **1000 lb/ft**.
 - 2. Total Load: 11,500 lbs per carriage.

2.3 SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard mobile storage shelving systems and components. Where components are not otherwise indicated, provide manufacturer's standard components as required for a complete system.
- B. Inserts: Furnish required concrete inserts and similar anchorage devices for installing track system, and furnish other components of work where installation of devices is specified in another Section.
- C. Tracks: Steel rails with tops machined to mate with guide wheels and with ends designed to provide smooth, secure continuity between sections without field welding. Provide mounting brackets, anchorage devices, adjustable leveling devices, and stops at terminations of rails to prevent carriages from running off track ends.
 - 1. Mounting: **Recessed**.
- D. Carriages: Rigid frames consisting of C-shaped cold-formed steel beams and cross beams, designed to allow secure anchorage of shelving units.
 - 1. Carriage Width: **(2) carriages are to be 36" and the rest are to be 25"**.
 - 2. Carriage Length: 11'-6" per plans.
 - 3. Wheels: Manufacturer's standard number of bearing-mounted, steel wheels, precision ground to mate with tracks.
 - 4. Bumpers: Provide two rubber bumpers with minimum depth of 1/2 inch each side.
- E. Anti-Tip Brackets: Mount on carriage for engagement with track system to secure units against tipping.
- F. Carriage End Panels: Full depth and height of shelving units. Provide at **both ends** of each range.
 - 1. Non-Operating End:

- a. Material: Cold-rolled steel sheet. Manufacturer's standard thickness but not less than basis of design.
- 2. Operating End:
 - a. Material: Fully enclosed laminated end panels must be constructed with General Contractor supplied laminate, bonded to a minimum 5/8" thick particle board core, and backed with a moisture resistant backer sheet. Frame is constructed from 16ga cold rolled steel and finished with a powder coating. **Laminate is to be PL-5 per the finish schedule on A6.04. General Contractor to supply manufacturer with laminate.**
 - b. All end panels must be self-edged for a finished appearance. Systems with t-molded or painted edges are not acceptable.
 - c. Decorative end panels are to be covered the entire width and height of the exposed shelving, while enclosing the drive box mechanism.

2.4 MECHANICALLY OPERATED SYSTEMS

- A. Drive Systems: Geared transmission and chain systems with tensioning device to provide mechanical assistance and uniform movement along entire length of each carriage. Permanently shielded and lubricated.
- B. Drive Shaft: Continuous tubular or solid steel shaft, capable of transmitting torque from drive system without distortion.
- C. Locking Pins: Located on range end panels to allow locking of individual range carriage when depressed.

2.5 STEEL FOUR-POST SHELVING

- A. Steel Four-Post Shelving: Shelving consisting of four angle-iron uprights per section, with adjustable shelves resting on shelf supports hung on uprights. Configure units for mounting on mobile carriages.
- B. Shelving Units
 - 1. **Type: Heavy duty, adjustable shelving.**
 - 2. **36" Wide Carriages**
 - a. **Configuration: Open shelving to be accessible for both sides of carriage.**
 - b. **Width: 48 inches.**
 - c. **Height: 90 inches.**
 - d. **Shelf Depth: 18 inches.**
 - e. **Shelf Styles: Provide the following styles and numbers of adjustable shelves:**
 - 1) **Carriages to have (6) adjustable shelves, not including the bottom shelf, full length of carriage (with breaks at necessary supports).**
 - 2) **Shelves are for storing boxes.**
 - 3. **25" Wide Carriages**
 - a. **Configuration: Open shelving to be accessible for both sides of carriage.**
 - b. **Width: 48 inches.**
 - c. **Height: 90 inches.**
 - d. **Shelf Depth: 12 inches.**

- e. **Shelf Styles: Provide the following styles and numbers of adjustable shelves:**
 - 1) **Carriages to have (7) adjustable shelves, not including the bottom shelf, full length of carriage (with breaks at necessary supports).**
 - 2) **Provide slotted shelves for dividers.**
 - 3) **Provide (4) dividers for each row between supports.**
 - 4) **Provide locking swing doors for (16) feet of shelving. Files within the locked doors cannot be accessible from other parts of the file system. Provide (4) keys for the locks.**
- 4. **Pull Out Shelves**
 - a. **Provide (1) pull out reading shelf on both sides of each 25" wide carriage.**
- C. Uprights: Double-wall steel posts, 2 inches wide, 0.048 inch thick, in manufacturer's standard T-shape for common-post use or L-shape at range ends, with keyhole perforations on the inner wall at 1-1/2 inches o.c.
- D. Steel Spacers: Provide 0.048-inch- thick steel spacers, 3 inches high, welded to posts at bottom, center, and top of open units to prevent deflection.
- E. Closed Back and Ends: 0.024-inch- thick cold-rolled steel sheet.
- F. Center Divider: 0.024-inch- thick cold-rolled steel sheets.
- G. Base: Manufacturer's standard for attachment to mobile carriages.
- H. Adjustable Steel Shelves: 0.030-inch- thick cold-rolled steel sheet.
 - 1. Shelf Supports: Full-shelf-width supports; 0.075-inch- thick steel, minimum 3/4 inches high, with flange to support shelf reinforcements and with ear at each end containing two shoulder rivets with 7/16-inch heads spaced to set into keyhole slots on uprights.
 - 2. Shelf Reinforcements: Channel shapes equal in length to depth of the supported shelf; 0.060-inch- thick steel channels, with notched ends to fit over inside lip of shelf support.

2.6 STEEL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: Medium Gray Metallic T23.

2.7 SYSTEM ACCESSORIES

- A. Floor Lock: Key-operated floor lock capable of securing entire system. Provide **two** keys.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, **minimum recess depth**, and other conditions affecting performance of mobile shelving systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Level and plumb tracks to a tolerance of 0.09 inch in 120 inches with no more than 0.06-inch variation between adjacent rails. Use permanent shims or non-shrink grout as indicated by manufacturer.
- B. Surface-Mounted Track Systems: Install underlayment, ramps, and finish flooring according to manufacturer's written instructions and flush with track surfaces. Do not extend ramps beyond ends of carriages.
- C. Recessed Track Systems: Solidly fill gaps between slab and rail according to manufacturer's written instructions to secure tracks and prevent movement.
- D. Carriage Installation: Mount mobile carriages on track system **with anti-tip brackets engaged by rails** and adjust for smooth operation. Provide non-moving carriages securely fixed to rails where indicated.

3.3 SHELVING INSTALLATION

- A. Attach shelving units to carriages according to manufacturer's written instructions and as required to prevent vibration during movement.
 - 1. Level and plumb shelving units to a tolerance of 1/8 inch in 96 inches.
- B. Starter/Adder Units: Connect groups together with standard fasteners according to manufacturer's written instructions, using concealed fasteners where possible.
- C. Install shelves in shelving units at locations indicated on Drawings and according to manufacturer's written instructions.
- D. Shelving Enclosure Panels: Install **end panels and canopy tops** with concealed fasteners.

3.4 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

- C. Protect installed products from damage during remainder of the construction period.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain mobile storage shelving.

END OF SECTION 10 5626

SECTION 10 7113 - EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 Summary

- A. Section includes: Kawneer Aluminum Sunshade Systems, including accessories, mountings, and shims. Sunshades are anchored directly to the vertical curtain wall or storefront mullions.

1. Compatible Systems:

- a. 1600UT System™1 Curtain Wall
- b. Trifab™ VersaGlaze™ 451/451T/451UT (Center Glaze) Framing System

B. Related Sections:

- 1. 07 9200 "Joint Sealants"
- 2. 08 4113 "Aluminum-Framed Entrances and Storefronts"
- 3. 08 8000 "Glazing"

1.2 Definitions

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.3 Performance Requirements

A. Structural Performance:

- 1. Combined load on sunshade configurations to be determined in accordance with ASCE 7 or applicable code requirements. Combined load consists of wind, snow and ice loads.
- 2. Design sunshade configurations to withstand stresses due to combined load. Stresses resulting from thermal expansion/contraction, shall not cause permanent deformation of sunshade assemblies or disengagement from the glazed system.
 - c. 1600UT (Ultra Thermal) System™1 Curtain Wall (1" Double Glazed Infill):
 - 1) 30" Outrigger: with airfoil style louver and mullion spacing per drawings.
 - d. Trifab™ VersaGlaze™ 451/451T/451UT (Center Glazed) Framing System:
 - 1) 30" Outrigger: with airfoil style louver and mullion spacing per drawings.
- 3. The assembled sunshade shall be capable of supporting the specified combined load without damage, permanent deformation, or disengagement from the glazed system mullion.
- 4. Blade deflection shall not exceed L/120 of span length.
- 5. Submit test reports verifying compliance with each test requirement required by the project.

B. Shading Performance:

- 1. Design of standard configurations will allow for negligible direct sunlight to show through the blades based on project location, latitude, altitude, building orientation, surrounding conditions, and aesthetic requirements, except for round, diamond and square louver styles.

- C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 Submittals

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum exterior sunshades. Include plans, elevations, sections, blade angles, blade spacing and attachments to compatible systems.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.5 Quality Assurance

- A. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating exterior sunshades, and glazed aluminum curtain walls and storefront systems that meet or exceed performance requirements.
- C. Source Limitations: Obtain aluminum exterior sunshades and glazed aluminum curtain walls and storefront system through one source from a single manufacturer.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockups for type(s) of sunshade elevation(s) indicated, in location(s) shown on Drawings.

1.6 Project Conditions

- A. Field Measurements: Verify actual locations of structural supports for sunshades by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 Warranty

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.

1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:

1. Versoleil™ Sunshade Outrigger System by Kawneer Company Inc.

B. Subject to compliance with requirements, provide a comparable product by the following:

1. Arcadia, Inc
2. EFCO Corporation
3. US Aluminum
4. Vistawall Architectural Products.

C. Substitutions: Refer to Substitutions Section for procedures and submission requirements.

1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid sunshade installation and construction delays.
3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for sunshade performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum curtain walls, storefront systems, and sunshades for a period of not less than ten (10) years. (Company Name).
5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

- A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall and storefront system manufacturer for strength, corrosion resistance, and application of required finish, and complying with ASTM B 221: 6063-T6, 6105-T5, or 6061-T6 alloy and temper. Wall thickness at any location for the main frame to be not less than 0.070".
- B. Thermal Barrier: When applied on a thermally broken captured system, sunshade shall be thermally isolated from the interior aluminum mullions by a nominal 0.25" thick low conductance material.
- C. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.

- D. Sealant: For sealants required within fabricated sunshade system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- E. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall and storefront members members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Sunshades

- A. Sunshade Members: Manufacturer's standard extruded or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- B. Fasteners and accessories: Nonmagnetic stainless steel to be non-corrosive and compatible with aluminum members, anchors, and other components.
- C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle sunshade materials and components to avoid damage. Protect sunshade materials against damage from elements, construction activities, and other hazards before, during and after installation.

2.4 Accessory Materials

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.5 Fabrication

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Sunshade: Fabricate components for assembly following approved shop drawings and/or manufacturer's standard installation instructions.

- D. After fabrication, clearly mark components to identify their locations in Project according to approved shop drawings.

2.6 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing: Black Finish to match storefront and curtain wall.

PART 3 - EXECUTION

3.1 Examination

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. General:

1. Comply with manufacturer's written instructions. Refer to installation instructions of the compatible curtain wall or storefront system.
2. Please note that the installation instructions can differ from one compatible system to another one.
3. Do not install damaged components.
4. Fit joints to produce hairline joints free of burrs and distortion.
5. Rigidly secure non-movement joints.
6. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of
7. moving joints.
8. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
9. Seal joints watertight where shown on approved shop drawings and/or manufacturer's standard installation instructions.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades.

- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

- E. Install glazing as specified in Division 08 Section “Glazing”.

3.3 Adlusting, Cleaning and Protection

- A. Protection: Protect installed product’s finish surfaces from damage during construction. Protect aluminum sunshade system from damage from grinding and polishing compounds, plaster, lime, cement, acid and/or acid wash, or other harmful contaminants.
- B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance. Remove construction debris from project site and legally dispose of debris.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 10 7113

SECTION 10 7516 - GROUND-SET FLAGPOLES

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 ground-set flagpoles made from **aluminum**.
- B. Owner-Furnished Material: Flags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles.
 - 1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
 - 2. Include section, and details of foundation system.
- C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
- D. Delegated-Design Submittal: For flagpoles.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, licensed to work in the State of Washington, to design flagpole assemblies.
- B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7** and the State of Washington .
- C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
 - 1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is **per Structural Plans**.
 - 2. Base flagpole design on **polyester, nylon or cotton** flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: **Entasis**-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
 - 1. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:
 - a. American Flagpole; a Kearney-National Inc. company.
 - b. Atlantic Fiberglass Products, Inc.
 - c. Flags-A'-Flying
 - d. Pole Tech
- B. Exposed Height: **30 feet**
- C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
 - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
 - 1. Flashing Collar: Same material and finish as flagpole.

- E. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
 - 1. Flashing Collar: Same material and finish as flagpole.
- F. Cast-Metal Shoe Base: Made from aluminum **with same finish and color as flagpoles** for anchor-bolt mounting; furnish with anchor bolts.
 - 1. Furnish ground spike.
- G. Hinged Baseplate: Cast-metal tilting hinged base and anchor plate joined by permanently secured pivot rod. Furnish with stainless-steel screws for securing tilting base to anchor plate when not tilted; furnish with anchor bolts.
 - 1. Finish: Same as flagpole.
 - 2. Furnish aluminum base or aluminum flashing collar finished to match flagpole.
 - 3. Furnish ground spike.
- H. Pivoting Tilt Base: Steel baseplate with channel or rectangular tube uprights, pivot bolt, and locking device for tilting flagpole. Furnish tilting flagpole with steel counterweight box and weights, or furnish with internal counterweight. Furnish base with anchor bolts.
 - 1. Finish: Same as flagpole.
 - 2. Furnish ground spike.
- I. Counterweight: Provide internal counterweight system.

2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch spun aluminum, **finished to match flagpole**.
- B. Internal Halyard, Cam Cleat System: **5/16-inch diameter, braided polypropylene** halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
 - 1. Halyard Flag Snaps: **Stainless-steel** swivel snap hooks **with neoprene or vinyl covers**. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.
- B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- C. Sand: ASTM C 33/C 33M, fine aggregate.

- D. Elastomeric Joint Sealant: Joint sealant complying with requirements in Section 079200 "Joint Sealants."
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, **AA-M12C22A42/A44**.
 - 1. Color: **Black**.
 - 2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.
- F. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.
- G. Place concrete, as specified in per Structural Plans and **Section 033000 "Cast-in-Place Concrete."** Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- H. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to **Shop Drawings and** manufacturer's written instructions.

- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.
- C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION 107516

SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples:

1. For each exposed product and for each color and texture specified, 10 inches long.
 - a. Fabric Material
 - b. Fascia

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years' experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.

- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of 10 years' experience in installing products comparable to those specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Manufacturer: For purposes of establishing minimum performance standards, this specification is based on the following:
 - 1. Manufacturer: Mecho
 - 2. Product: Mecho 5X
- B. Available Manufacturer: Subject to compliance with requirements, provide a comparable product by, but not limited to, the following:
 - 1. Hunter Douglas
- C. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount

- D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of interior face of shade
 - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- G. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: Nickel 1610
- H. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches
 - 2. Endcap Covers: To cover exposed endcaps.
 - 3. Installation Accessories Color and Finish: Black

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: PVC-coated polyester
 - 3. Weave: Basketweave
 - 4. Roll Width: Coordinate with Window Schedule
 - 5. Orientation on Shadeband: Up the bolt
 - 6. Openness Factor: Soho 1600 Series- 3 percent open.
 - 7. Color: Nickel 1610

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Roller Shade Locations: As indicated on Drawings

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 2413

SECTION 12 3661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Quartz agglomerate countertops.
 - 2. Quartz agglomerate backsplashes.
 - 3. Quartz agglomerate end splashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
 - 1. Manufacturer: Wilsonart
 - 2. Colors and Patterns: As indicated in drawings.
- B. Particleboard: ANSI A208.1, **Grade M-2-Exterior Glue.**
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WT's "Architectural Woodwork Standards."
 - 1. Grade: **Premium.**
- B. Configuration:
 - 1. Front: **Straight, slightly eased at top.**

2. Backsplash: **Straight, slightly eased at corner.**
 3. End Splash: **Matching backsplash.**
- C. Countertops: 2cm & 3 cm thick (per plans), quartz agglomerate **with front edge built up with same material.**
- D. Backsplashes: 2cm & 3 cm thick (per plans), quartz agglomerate.
- E. Joints: Fabricate countertops without joints.
- F. Joints: Fabricate countertops in sections for joining in field. **Provide joints at locations shown in plans.**
- G. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 2. Grommets: Provide 2" grommet openings as required by Architect. **Coordinate locations with Architect during submittals.** Provide grommet inserts to best match quartz finish.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
- F. Install aprons to backing and countertops with adhesive.

- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 12 3661.19

SECTION 12 4813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor mats and Recessed Frame Assemblies.

1.2 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products, in manufacturer's standard sizes:
 - 1. Floor Mat: Assembled sections of floor mat.
 - 2. Tread Rail: Sample of each type and color.
 - 3. Frame Members: Sample of each type and color.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Structural Performance: Provide floor mats and recessed frame assemblies capable of withstanding the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform floor load of 300 lbf/sq. ft.
 - 2. Wheel load of 400 lb.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities..

2.2 RECESSED FLOOR MATS AND FRAME ASSEMBLIES

A. Recessed Frames: Manufacturer's standard extrusion.

1. Extruded Aluminum: ASTM B 221, Alloys 6105-T5 for rail extrusions and 6061-T6 for key lock bars.
 - a. Manufacturer: American Floor Mats
 - b. Product: 3/4" Recessed Grille Mat
 - c. Color/Material: Black Iron Carpet, Anodized Clear Aluminum Framing
 - 1) Grille mat shall be extruded 6105-T5 aluminum alloy treat rails joined mechanically by extruded 6106-T6 aluminum alloy key lock bars (welding or bolting shall not be permitted) Rail finish to be mill (standard) anodized.
 - d. Frame: LB – Level Base Frame shall be 6063-T5 aluminum alloy with 1/2" exposed surface and a depth of 3/4". These assemblies receive 1/4" thick heavy gauge support cushions 1" long mounted to each continuous foot at 20" on center. Frame color shall be supplied in mill. **Note:** Mill finish frames in contact with concrete to be primer coated.

2.3 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
 1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12 4813

SECTION 12 9300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bicycle racks.
 - 2. Trash receptacles.
 - 3. Bollards.
 - 4. Payment Drop Box
- B. Related Requirements:
 - 1. Section 03 3000 "Cast-in-Place Concrete" for installing pipe sleeves cast and installing anchor bolts cast in concrete footings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 EXTRA MATERIAL

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Trash Receptacle Inner Containers: **1 full-size unit.**

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
 - 1. 5 loop design per plans, Surface mounted or in sleeves, powder coat, black.
- B. Bicycle Rack Construction:

1. Frame: Steel
 - a. Pipe or Tubing OD: Not less than 1-5/8 inches.
2. Style: 5 loop
 - a. Overall Height: 36"
 - b. Overall Width: Not less than 64"
 - c. Capacity: Designed to accommodate no fewer than five bicycles.
3. Security: Designed to lock wheel and frame.
4. Installation Method: Surface flange anchored at finished grade to substrate indicated.

C. Steel Finish: Powder coated.

1. Color: Black.

2.2 TRASH RECEPTACLES

- A. Manufacturer: Wabash Valley
- B. Product: Elegance – J Style 32 Gallon Outdoor Trash Receptacle with Liner.
- C. Mounting: Surface mounted.
- D. Lid: Solid Bonnet
- E. Door: Side Door
- F. Finish: Powder Coated
- G. Color: Black

2.3 BOLLARDS : Type 1

- A. For purposes of establishing minimum performance standards, this specification is based on the following:
 1. BollardsUSA.com, A division of Jr Hoe, 380-SF Stainless Steel.
- B. Bollard Construction:
 1. Pipe OD: Not less than 6" inches .
 - a. Steel: Schedule 40 pipe.
 2. Style: Dome top
 3. Overall Height: As indicated
 4. Overall Depth: As indicated
 5. Installation Method: Cast in concrete

- C. Steel Finish: Per 09 9600 High Performance Coatings.
- D. Color: Per plans

2.4 BOLLARDS : Type 4 Removable

- A. Manufacturer: Traffic Guard Inc.
- B. Product: Series RP6601
- C. Bollard Construction:
 - 1. Pipe OD: 6.625”.
 - 2. Height: 36”
 - 3. Overall Depth: Per manufacturer
 - 4. Sleeve: Manufacturer’s standard galvanized
 - 5. Installation Method: Sleeve cast in concrete
 - 6. Locking system: None
- D. Steel Finish:
 - 1. Prime: Factory primed
 - 2. Finish: Per 09 9600 High Performance Coatings.
 - 3. Color: Per plans.

2.5 PAYMENT DROP BOX

- A. Manufacturer: Covenant Security Equipment
- B. Product: CSE-AS-400-DIG-COMBO
- C. Installation: In ground
- D. Style: Drive up
- E. Finish: Stainless
- F. Signage: “Skagit PUD Payments”

2.6 MATERIALS

- A. Steel and Iron: Free of surface blemishes and complying with the following:
 - 1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
- B. Anchors, Fasteners, Fittings, and Hardware: **Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials**; commercial quality, **tamperproof, vandal and theft resistant**.

- C. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.
- D. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
- E. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
 - 1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
 - 2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.7 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.8 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and **securely anchored** at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **nonshrink, nonmetallic grout or anchoring cement**, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with **nonshrink, nonmetallic grout or anchoring cement**, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 12 9300

SECTION 14 2400 - HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:
1. Standard pre-engineered hydraulic passenger elevators.
 2. Elevator car enclosures, hoistway entrances and signal equipment.
 3. Operation and control systems.
 4. Jack(s).
 5. Accessibility provisions for physically disabled persons.
 6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
 7. Materials and accessories as required to complete the elevator installation.
- B. Related Sections:
1. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
 2. Division 5 Metals:
 - a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
 - b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
 3. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
 4. Division 16 Sections:
 - a. Providing electrical service to elevators, including fused disconnect switches.
 - b. Emergency power supply, transfer switch and auxiliary contacts.
 - c. Heat and smoke sensing devices.
 - d. Convenience outlets and illumination in control room, hoistway and pit.
 5. Division 22 Plumbing
 - a. Sump pit and oil interceptor.
 6. Division 23 Heating, Ventilation and Air Conditioning
 - a. Heating and ventilating hoistways and/or control room.
- C. General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent.
1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
 2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
 3. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
 4. Elevator hoistways shall have barricades, as required.

5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. Machine room to be enclosed and protected.
10. Machine Room temperature must be maintained between 55° and 90° F.
11. If machine room is remote from the elevator hoistway, clear access must be available above the ceiling or metal/concrete raceways in floor for oil line and wiring duct from machine room.
12. Access to the machinery space and machine room must be in accordance with the governing authority or code.
13. Provide an 8" x 16" cutout through machine room wall, for oil line and wiring duct, coordinated with elevator contractor at the building site.
14. All wire and conduit should run remote from the hoistways.
15. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
16. Install and furnish finished flooring in elevator cab.
17. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
18. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
19. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
20. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
21. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
22. General Contractor shall fill and grout around entrances, as required.
23. Elevator sill supports shall be provided at each opening.
24. All walls and sill supports must be plumb where openings occur.
25. For applications with jack hole, free and clear access to the elevator pit area for the jack hole-drilling rig is required.
26. Where jack hole is required, remove all spoils from jack hole drilling.

27. When not provided by Elevator Contractor, jack hole shall accommodate the jack unit. If required the jack hole is to be provided in strict accordance with the elevator contractor's shop drawings.
28. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
29. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).
30. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch.
31. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.
32. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.
33. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..
34. Locate telephone and convenience outlet on control panel.

1.02 SUBMITTALS

- A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.
- B. Shop drawings:
 1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
 2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
 3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
 4. Indicate electrical power requirements and branch circuit protection device recommendations.
- C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- E. Metal Finishes: Upon request, standard metal samples provided.
- F. Operation and maintenance data. Include the following:
 1. Owner's manuals and wiring diagrams.
 2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
 - 1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
 - a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
 - 2. The manufacturer shall have a documented, on-going quality assurance program.
 - 3. ISO-9001:2000 Manufacturer Certified
 - 4. ISO-14001:2004 Environmental Management System Certified
 - 5. LEED Gold certified elevator manufacturing facility.
- B. **Installer Qualifications:** The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.
- C. **Regulatory Requirements:**
 - 1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
 - 2. Building Code: National.
 - 3. NFPA 70 National Electrical Code.
 - 4. NFPA 80 Fire Doors and Windows.
 - 5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
 - 6. Section 407 in ICC A117.1, when required by local authorities
 - 7. CAN/CSA C22.1 Canadian Electrical Code
 - 8. CAN/CSA B44 Safety Code for Elevators and Escalators.
 - 9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350
- D. **Fire-rated entrance assemblies:** Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).
- E. **Inspection and testing:**
 - 1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
 - 2. Arrange for inspections and make required tests.
 - 3. Deliver to the Owner upon completion and acceptance of elevator work.
- F. **Product Qualifications:**

1. LCA, EPD and HPD data must be provided for all major components of the elevator system.
 2. LCA data must be compatible with GaBI Software.
 3. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
 4. GreenScreen Chemical Hazard Analysis: All ingredients of 100 parts-per-million or greater evaluated using GreenScreen for Safer Chemicals Method v1.2.
 5. Health Product Declarations (HPD v2 or later): Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool; Unknown hazard listed will not be considered acceptable.
- G. Material: All components shall be of the manufacturer's most current design and include the latest in elevator IoT monitoring technology.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

- A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.
- B. Provide the hole for the jack unit (if required by the type of jack provided), based on excavation through normal soil or clay which can be removed by manual digging or by standard truck-mounted regular drilling unit. Provide a casing if required to retain the walls of the hole. General contractor shall remove excavation spoils deposited in the elevator pit.
1. If a physical obstruction or hindrance is encountered below the ground surface, including boulders, rock, gravel, wood, metal, pilings, sand, water, quick sand, caves, public utilities or any other foreign material, obtain written authorization to proceed with excavating using special excavation equipment.
 2. Maintain a daily log of time and material costs involved.
 3. Elevator contractor will be compensated on a time and material basis for additional costs incurred after encountering the physical obstruction or hindrance, including the cost of the special excavation equipment.

1.06 WARRANTY

- A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
 - 1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
 - 2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
 - 3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Design based is ThyssenKrupp.
- B. Product: Endura Hydraulic Elevator
- C. Contact: Gretchen Champaine, (509) 413-3356 or Gretchen.Champaine@ThyssenKrupp.com

2.02 MATERIALS, GENERAL

- A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.
- B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.
- C. Steel:
 - 1. Shapes and bars: Carbon.
 - 2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
 - 3. Finish: Factory-applied powder coat for structural and architectural parts. Color selection must be based on elevator manufacture's standard selections.
- D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.
- E. Flooring: **T-1 tile per drawings.**

2.03 HOISTWAY EQUIPMENT

- A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.
- B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
- D. Guides: Slide guides shall be mounted on top and bottom of the car.
- E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.
- F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the Assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..
- G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.
- H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

2.04 POWER UNIT

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:
 - 1. An oil reservoir with tank cover.
 - 2. An oil hydraulic pump.

3. An electric motor.
 4. An oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.
- D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
 2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
 3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
 5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
 6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
 7. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
 2. Main landing door & frame finish: Pitch Black F-112.
 3. Typical door & frame finish: Pitch Black F-112.

- B. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
 - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 - 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
 - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

- A. Car Enclosure:
 - 1. Walls: Applied panels with 5WL Stainless Steel finish.
 - 2. Reveals, base and frieze: Stainless steel, no. 4 brushed finish
 - 3. Canopy: Cold-rolled steel with hinged exit.
 - 4. Ceiling: Suspended type, metal pan downlight ceiling with (9) LED lights.
 - 5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel
 - 6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
 - a. Door Finish: Pitch Black F-112
 - b. Cab Sills: Extruded aluminum, mill finish.
 - 7. Handrail: Flat bar style. 4" width. Handrails shall have a stainless steel, no. 4 brushed finish.
 - 8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
 - 9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.
- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be

digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
 2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
 3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
 4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
 5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
 6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
 7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
 8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.
- B. Emergency Communications System: Integral phone system provided.
- C. Auxiliary Operating Panel: Not Applicable
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.
- E. Special Equipment: Not Applicable

2.09 CONTROL SYSTEMS

- A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- C. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.
- D. Special Operation: Not Applicable

2.10 HALL STATIONS

- A. Hall Stations, General: Vandal resistant buttons with center jewels which illuminate to indicate that a call has been registered at that floor for the indicated direction. Each button shall be provided with

an internal automatic stop to prevent damage of switches that register the call. Provide 1 set of pushbutton risers. All fixtures shall be vandal resistant type.

1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
 - a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Hall Position Indicator: Not Applicable
- D. Hall lanterns: Not Applicable
- E. Special Equipment: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing arranged for inspecting interior parts without removing unit from oil line.
- B. Fireman's Lockbox: Provide fireman's lockbox with two (2) keys for each keyed operation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
 2. Comply with the National Electrical Code for electrical work required during installation.

- B. Jack unit excavation: Drill or otherwise excavate below elevator pit construction as required to install the jack unit.
 - 1. Install casing for jack unit.
 - 2. Provide HDPE jack protection system for all in ground jacks.
 - 3. Set casing for jack unit assembly plumb, and partially fill with water set-tled sand, eliminating voids. Back fill depth shall be sufficient to hold the bottom of the jack in place over time.
- C. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
- D. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
- E. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.
- F. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
- G. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
- H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
- I. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.
- J. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

- B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

- A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.
- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
 - 1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

- A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
- B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

- A. Elevator Qty. 1

1. Elevator Model: endura Twinpost above-ground 2-stage
2. Elevator Type: Hydraulic Passenger
3. Rated Capacity: 2500 lbs.
4. Rated Speed: 80 ft./min.
5. Operation System: TAC32H
6. Travel: 13'-0"
7. Landings: 2 total
8. Openings:
 - a. Front: 2
 - b. Rear: 0
9. Clear Car Inside: 6'-8" wide x 4'-3" deep
10. Inside clear height: 7'-4" standard
11. Door clear height: 7'-0" standard
12. Hoistway Entrance Size: 3'-6" wide x 7'-0" high
13. Door Type: One-speed | LH Side opening
14. Power Characteristics: 208 volts, 3 Phase, 60 Hz.
15. Seismic Requirements: Yes
16. Hoistway Minimum Dimensions: 8'-4" wide x 5'-9" deep
17. Pit Depth: 4'-0"
18. Button & Fixture Style: Vandal Resistant Signal Fixtures
19. Special Operations: None

3.09 SPECIAL CONDITIONS

- A. Not applicable.

END OF SECTION 14 2400

**SECTION 210001
FIRE SUPPRESSION DESIGN BUILD**

PART 1 GENERAL

1.01 CONFORM TO THE ARCHITECTURAL SECTIONS AND RELATED WORK IN OTHER DIVISIONS FOR ALL WORK IN THIS DIVISION.

A. DESIGN BUILD SUMMARY

1. The contractor shall furnish, design, and install all components of the sprinkler system in the building. Contractor shall include all costs to have the sprinkler system designed by a licensed fire protection engineer or NICET III (or other AHJ approved) sprinkler designer.
2. This specification assumes the underground fire main will be installed by others (not a part of this specification) and stubbed into the fire riser room with a flange ready for the building sprinkler system to connect. **This contractor shall ensure the General Contractor is aware of this statement and the General Contractor has the underground fire line into the building covered by an appropriately licensed contractor.**
3. The entire building will be a heated space and will require a wet fire sprinkler system. Entry canopy will require a dry system. Provide sprinkler coverage per code and AHJ.
4. The owner has chosen to use a light hazard rated system and the fire marshal has also approved a light hazard rated system if allowed by code. Contractor to confirm during design.
5. A fire riser room has been planned. Civil has indicated an outdoor double detector check valve assembly with PIV, FDC and a new fire line to the building fed from the City of Mount Vernon water system. See the Civil plans for additional information.
6. Pressure at the site is 58 psi residual at 2260 gpm and 79.3 psi static based on a preliminary fire flow test. Contractor shall confirm and obtain a new fire flow test for their design work.
7. Contractor shall coordinate with the fire marshal for any specific requirements.

B. SYSTEM DESCRIPTIONS

1. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to a municipal water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included.
2. Clean Agent fire suppression system for server room: The server room shall have both, a dedicated "clean agent" fire suppression system (such as FM200) and heads from the building's wet sprinkler system. The FM200 suppression system shall be designed to be activated before the wet system heads using heat and smoke detection. The wet heads inside the sprinkler room will be installed on a double interlocked pre-action system. This pre-action system will function as follows:
 - a. There will be a detector in the server room, which when triggered will open a pre-action valve and allow water to flow past the pre-action valve to the wet sprinkler heads.
 - b. The sprinklers will then be energized but will not flow water.
 - c. Once the temperature dependent bulb in the head bursts due to heat, water will flow to suppress the fire.
 - d. Two events will have to occur for water to flow out of the heads. The detector is activated and the sprinkler head is activated. This prevents the head from accidentally activating due to being bumped or a faulty head.
3. Dry Pipe Sprinkler System: Automatic sprinklers are attached to piping containing air or nitrogen under pressure. When a sprinkler opens by heat melting a fusible link or destroys a frangible device, air is released which permits the water pressure to open a dry type valve at the riser. Water then flows through the piping system and out the opened sprinkler(s) in the required timeframe.
 - a. A dry-type system shall be used for the front entry, canopy unless the designer of record can prove sprinkler coverage is not required per code and fire marshal. Note dry head sprinklers likely will not work since glazing systems goes to ceiling.

C. PERFORMANCE REQUIREMENTS

1. Fire-suppression sprinkler system design shall be approved by the Fire Marshal. Base calculations on results of fire-hydrant flow test.
 - a. Margin of Safety for Available Water Flow and Pressure: 10% or 10 LBS, whichever is greater OR as per AHJ, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications: Light Hazard or as defined by code and AHJ, whichever is more stringent.
 - c. Minimum Density for Automatic-Sprinkler Piping Design: All areas shall have gpm coverage per square foot according to NFPA13 and AHJ.
 - d. Maximum Protection Area per Sprinkler: ALL Areas: 130 sq. ft.
 - e. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 and AHJ.
 - f. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASME-7. See section 210548.

D. SUBMITTALS

1. Reference Architectural specifications for additional submittal requirements.
2. Product Data: Submit for the following:
 - a. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
 - b. Pipe hangers and supports, including seismic restraints.
 - c. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 - d. Air compressors, including electrical data (when applicable).
 - e. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - f. See all other sections for additional requirements.
3. Submit Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, which have been approved by the Fire Marshal including hydraulic calculations. Provide electronic PDF to scale.
4. Submit 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".
5. Submit Field quality-control test reports.
6. Submit Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals. Provide (4) four copies. See other sections for additional requirements.

E. QUALITY ASSURANCE

1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III or IV engineering technician.
2. Welding: Operators to be qualified with processes according to ASME Boiler and Pressure Vessel Code: Section IX.
3. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the appropriate version of the following:
 - a. NFPA 13, "Installation of Sprinkler Systems."
 - b. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
 - c. NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems."

F. COORDINATION

1. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies in order to comply with NFPA 13 requirements regarding obstructions to sprinkler discharge. Sprinklers shall be a minimum of 18 inches from HVAC inlets and outlets.
2. Coordinate with all trades prior to install.

G. EXTRA MATERIALS

1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Provide enough cabinets for all spare sprinkler head stock.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. All material shall be new and UL listed.
 - a. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) National Fittings, Inc.
 - 4) Southwestern Pipe, Inc.
 - 5) Victaulic Co. of America.
 - 6) Ward Manufacturing.
 - 7) Watts Industries, Inc.; Water Products Div.
 - 8) Zurn Industries, Inc.; Wilkins Div.
 - 9) Reliable Sprinkler Co.
 - 10) Viking Sprinkler Co.
 - 11) Merit Manufacturing.

B. SPRINKLERS

1. See 211300 for additional requirements including location for specific sprinkler types.
2. Basic Requirements
 - a. Sprinklers shall be UL listed, with 175 psi minimum pressure rating.
 - b. Sprinkler temperature rating shall be 155 and 175 °F for all occupancies except for the following: (1) sprinklers designed for 200 °F shall be used in electric closets, and (2) high-temperature sprinklers rated at 286 °F with sprinkler head guards shall be used in mechanical rooms, electrical rooms, electrical switchgear and transformer rooms, and any other areas in which high temperatures will routinely be experienced.
 - c. Quick-response sprinklers are to be used throughout, except where standard response heads are required.
3. Automatic Sprinklers: With heat-responsive element complying with the following:
 - a. UL 199, for nonresidential applications.
4. Sprinkler types, features, and options as follows:
 - a. Pendant sprinklers.
 - b. Recessed sprinklers.
 - c. Sidewall sprinklers.
 - d. Upright sprinklers.
5. Sprinkler Finishes: Brass.
6. Special Coatings: No special coatings required.
7. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

- a. Ceiling Mounting: White Concealed Plate, with “oops” ring if hard piped to ceiling.
- 8. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Guards shall be specifically listed for the sprinkler on which they are being installed.
- C. PRESSURE GAGES
 - 1. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 300 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare and submit sprinkler shop drawings utilizing NFPA 13 pipe & hydraulic calculations.
 - 1. Sprinkler system material data and shop drawing(s), including hydraulic calculations shall be approved by the Fire Marshal before materials are ordered and/or work begins.
 - 2. A set of approved drawings shall be maintained at the work site.
- B. EXAMINATION
 - 1. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction. Field verify actual construction and dimensions notify architect of any discrepancies.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. PIPING APPLICATIONS, GENERAL
 - 1. Shop weld pipe joints where welded piping is indicated.
 - 2. Do not use welded joints for galvanized-steel pipe.
 - 3. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
 - 4. Provide a main drain valve piped to an adequately sized sanitary drain. Coordinate with the plumbing contractor.
- D. SPRINKLER SYSTEM PIPING APPLICATIONS
 - 1. Standard-Pressure, Wet-Pipe Sprinkler System, 175 psi Maximum Working Pressure:
 - a. Mechanical Tees Allowed.
 - b. NPS 2" and smaller: threaded-end, black pipe, standard-weight steel pipe; cast-ductile-, od malleable- iron threaded fittings; and threaded joints.
 - c. NPS 2" and larger: grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end pipe couplings; and grooved joints.
- E. VALVE APPLICATIONS
 - 1. Where specific valve types are not indicated, the following requirements apply:
 - a. Listed Fire-Protection Valves: UL listed for applications where required by NFPA 13.
 - 1) Shutoff Duty: Use ball, butterfly, or gate valves. Use indicating type valves.
 - b. Unlisted General-Duty Valves: For applications where UL-listed valves are not required by NFPA 13.
 - 1) Shutoff Duty: Use ball, butterfly, or gate valves. Use indicating type valves.
 - 2) Throttling Duty: Use ball or globe valves.
- F. JOINT CONSTRUCTION
 - 1. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads.
 - 2. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - a. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - b. Copper Tube: Roll-groove tubing. Use grooved-end fittings and grooved-end-tube couplings.
 - 3. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 - a. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
 - b. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - c. NPS 6 and Larger: Use dielectric flange insulation kits.
- G. PIPING INSTALLATION

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Contracting Officer before deviating from approved working plans.
2. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
3. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
4. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
5. Install sprinkler piping with drains for complete system drainage. Coordinate with plumbing contractor for floor sink in riser room to allow for test discharge.
6. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
7. Hangers and Supports: Install and comply with NFPA 13 for hanger installation and materials.
8. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
9. Install piping concealed above finished ceilings unless approved in writing from Architect to be exposed.

H. VALVE INSTALLATION

1. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
2. 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.
3. Install control valves a minimum of 2 ft. -0 in. and a maximum of 6 ft. - 0 in. above the floor or per AHJ/code requirements.
4. Where valves are located above hard ceilings, access shall be provided by a minimum of 18 in. by 18 in. access panel (coordinate with GC).

I. SPRINKLER APPLICATIONS

1. Use the following sprinkler types:
 - a. All areas north of Gridline 4 in plans shall have recessed, concealed heads.
 - b. Reception 103, Stairs S01, Engineering lobby 201, and Coho room 202 shall have recessed, concealed heads.
 - c. All recessed head covers in areas with Faux wood paneling shall be a brown color matching wood ceiling finish. Coordinate finish colors with Architect
 - d. Rooms without Ceilings: Upright sprinklers.
 - e. All other rooms with Suspended Ceilings: Concealed sprinklers.
 - f. Wall Mounting: Sidewall sprinklers. (Concealed when used in suspended ceiling areas)
 - g. Sprinkler Finishes:
 - 1) Upright, Pendant, and Sidewall Sprinklers: Brass finish in all areas.
 - 2) Concealed Sprinklers: Rough brass, with factory-painted white cover plate on white ceilings or paint to match ceiling color.

J. SPRINKLER INSTALLATION

1. Install sprinklers in suspended ceilings in line with other heads not necessarily center line to any tiles.
2. Do not install pendant or sidewall, wet-type sprinklers in areas subject to freezing. Use dry- type sprinklers with water supply from heated space.
3. There shall not be any sprinkler head coming directly off a branch line fitting, with a minimum of a 1 inch outlet.
4. Install approved sprinkler guards on sprinklers at obstruction sprinklers located below ducts or other obstructions, in other locations identified in NFPA or areas less than 7'-0" HT or exposed to possible mechanical damage (closets, mechanical rooms, etc.).

5. Coordinate with code, other trades and fire marshal regarding installation of sprinklers above the grid ceiling.
- K. CONNECTIONS
1. Install piping so as to maintain equipment service and maintenance clearances.
 2. Connect alarm devices to fire alarm (Coordinate with fire alarm contractor).
- L. FIELD QUALITY CONTROL
1. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Energize circuits to electrical equipment and devices.
 - d. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - e. Coordinate with fire alarm tests. Operate as required.
- M. CLEANING AND PROTECTION
1. Clean dirt and debris from sprinkler system.
 2. Remove and replace sprinklers if painted with other than factory finish.
 3. Protect sprinklers from damage until Substantial Completion including any existing sprinklers.

END OF SECTION 210001

**SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Above ground piping.
- B. Buried piping.
- C. Escutcheons.
- D. Expansions - hose and braid.
- E. Mechanical couplings.
- F. Mechanical pressed fittings.
- G. Pipe hangers and supports.
- H. Pipe sleeves.
- I. Pipe sleeve-seal systems.
- J. Piping specialties.
- K. Pressure gauges.

1.02 RELATED REQUIREMENTS

- A. Section 078413 Penetration Firestopping.
- B. Section 099123 - Interior Painting: Preparation and painting of interior fire protection piping systems.
- C. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- D. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- E. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- B. ASME B40.100 - Pressure Gauges and Gauge Attachments 2022.
- C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- D. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).
- E. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use 2021.
- F. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
- G. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- H. AWWA C606 - Grooved and Shouldered Joints 2022.
- I. FM (AG) - FM Approval Guide Current Edition.
- J. ITS (DIR) - Directory of Listed Products Current Edition.
- K. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL (DIR) - Online Certifications Directory Current Edition.

- M. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 210001 for submittal procedures and additional requirements.
- B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- D. Operation and Maintenance Data: Include installation instructions and spare parts lists.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
 - 1. Minimum three years experience.
- C. Comply with FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey requirements.
- D. Valves: Bear FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.07 WARRANTY

- A. See Section 017700 Project Closeout for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Sprinkler-based System:
 - 1. Comply with NFPA 13.
 - 2. See Section 211300.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 40, black.
 - 1. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 2. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.03 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.
- B. Clearances:
 - 1. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.04 ESCUTCHEONS

- A. Manufacturers:
 - 1. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.
 - 2. Viking Group Inc; _____: www.vikinggroupinc.com/#sle.
- B. Material:
 - 1. Chrome-plated.
 - 2. Metals and Finish: Comply with ASME A112.18.1.
- C. Construction:
 - 1. One-piece.
 - 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.05 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.
- C. Vertical Support: Steel riser clamp.
- D. Seismic Hangers and Couplings:
 - 1. Provide coupling with a factory set disengagement rating of 140 percent to 160 percent of the static weight.
 - 2. Provide resettable and reusable, break away couplings.
 - 3. Provide tether cables to avoid excessive seismic joint movement.
 - 4. Coupling to be manufactured from non-corrosive materials.
 - 5. Manufacturers:
 - a. The Metraflex Company; Seismic BreakAway Hanger: www.metralfire.com/#sle.

2.06 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

- A. Manufacturers:
 - 1. The Metraflex Company; FireLoop: www.metralfire.com/#sle.
- B. Provide flexible loops with two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return with support bracket and air release or drain plug.
- C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- D. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
 - 1. Provide necessary accessories including, but not limited to, swivel joints.

2.07 MECHANICAL COUPLINGS

- A. Manufacturers:
 - 1. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.
 - 2. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.
- B. Rigid Mechanical Couplings for Grooved Joints:
 - 1. Dimensions and Testing: Comply with AWWA C606.
 - 2. Minimum Working Pressure: 300 psig (2065 kPa).
 - 3. Housing Material: Fabricate of ductile iron complying with ASTM A536.

4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

2.08 MECHANICAL PRESSED FITTINGS

- A. Manufacturers:
 1. Apollo Valves; _____: www.apollovalves.com/#sle.
- B. Provide double-pressed type, utilizing EPDM, nontoxic, synthetic rubber sealing elements for use with Schedule 40 carbon steel piping.

2.09 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
 1. Activate electric alarm.
 2. Test and drain valve.
 3. Replaceable internal components without removing valve from installed position.
 4. Manufacturers:
 - a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.
- B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
 1. Activate electric alarm.
 2. Test and drain valve.
 3. Externally resettable.
 4. Replaceable internal components without removing valve from installed position.
- C. Preaction Valve:
 1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for indicated remote, local, and manual releases.
 2. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.
- D. Auxiliary Drains: Condensate collection drain for each section of trapped pipe in preaction or dry fire protection system.
- E. Air Venting Valves:
- F. Commercial Riser Manifold: Preassembled and tested riser manifold in accordance with NFPA 13.
- G. Test Connections:
 1. Inspector's Test Connection for Preaction and Dry Pipe Systems:
 - a. Provide test connections approximately 6 feet (2 m) above floor for each or portion of each sprinkler system equipped with an alarm device, located at most remote part of each system.
 - b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
 - c. Supply discharge orifice with same size as corresponding sprinkler orifice.
 - d. Limit vertical height of exterior wall penetration to 2 feet (0.61 m) above finished grade.
- H. Water Flow Switch: Vane-type switch for mounting horizontally or vertically, with two contacts; rated 10 A at 125 VAC and 2.5 A at 24 VDC.

2.10 PRESSURE GAUGES

- A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Diameter: 4-1/2 inch (115 mm).
3. Mid-Scale Accuracy: One percent.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

3.02 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 1. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 2. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 3. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- I. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 1. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
- J. Escutcheons:
 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- K. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 210500

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SECTION 210523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Two-piece ball valves with indicators.
- B. Bronze butterfly valves with indicators.
- C. Iron butterfly valves with indicators.
- D. Check valves.
- E. Trim and drain valves.

1.02 RELATED REQUIREMENTS

- A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.
- B. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
- C. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- D. Section 211300 - Fire-Suppression Sprinkler Systems.
- E. Section 284600 - Fire Detection and Alarm.

1.03 ABBREVIATIONS AND ACRONYMS

- A. EPDM: Ethylene-propylene diene monomer.
- B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- C. NRS: Non-rising stem.
- D. OS&Y: Outside screw and yoke.
- E. PTFE: Polytetrafluoroethylene.
- F. SBR: Styrene-butadiene rubber.

1.04 REFERENCE STANDARDS

- A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- B. AWWA C606 - Grooved and Shouldered Joints 2022.
- C. FM (AG) - FM Approval Guide Current Edition.
- D. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies 2022, with Errata.
- F. UL (DIR) - Online Certifications Directory Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

- A. See Section 01 3300 for submittal procedures and additional requirements.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.07 QUALITY ASSURANCE

- A. Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Installer and Maintenance Contractor Qualifications:
 - 1. Company specializing in performing the work of this section with minimum five years documented experience.
 - 2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
 - 3. Complies with manufacturer's certification requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors and maintain at higher than ambient dew point temperature.
 - b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.
- C. Use the following precautions for handling:
 - 1. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. UL Listed: Provide valves listed in UL (DIR) and bearing UL mark.
- B. FM Global Approved: Provide valves listed in FM (AG) Approval Guide.
- C. Comply with AWWA C606 for grooved-end connections.
- D. Comply with NFPA 13 and NFPA 13R for valves.
- E. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
 - 2. Handwheel: For other than quarter-turn trim and drain valves.
 - 3. Hand-lever: For quarter-turn trim and drain valves 2 NPS (50 DN) and smaller.

2.02 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Description:
 - 1. Minimum Pressure Rating: 175 psig (1200 kPa).
 - 2. Body Design: Two piece.
 - 3. Body Material: Forged brass or bronze.
 - 4. Port Size: Full or standard.
 - 5. Seat: PTFE.
 - 6. Stem: Bronze or stainless steel.
 - 7. Ball: Chrome-plated brass.
 - 8. Actuator: Worm gear or traveling nut.

2.03 BRONZE BUTTERFLY VALVES WITH INDICATORS

- A. Minimum Pressure Rating: 175 psig (1200 kPa).
- B. Body Material: Bronze.
- C. Seat: EPDM.
- D. Stem: Bronze or stainless steel.
- E. Disc: Bronze with EPDM coating.
- F. Actuator: Worm gear or traveling nut.
- G. Supervisory Switch: Internal or external.

2.04 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Minimum Pressure Rating: 175 psig (1200 kPa).
- B. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, polyamide, or _____ coating.
- C. Seat: EPDM.
- D. Stem: Stainless steel.
- E. Disc: Ductile iron, nickel plated.
- F. Actuator: Worm gear or traveling nut.
- G. Supervisory Switch: Internal or external.
- H. Body Design: Grooved-end connections.

2.05 CHECK VALVES

- A. Minimum Pressure Rating: 175 psig (1200 kPa).
- B. Type: Center guided check valve.
- C. Body Material: Cast iron, ductile iron.
- D. Center guided check with elastomeric seal.
- E. Hinge Spring: Stainless steel.
- F. End Connections: Flanged, grooved, or threaded.

2.06 TRIM AND DRAIN VALVES

- A. Ball Valves:
 - 1. Description:
 - a. Pressure Rating: 175 psig (1200 kPa).
 - b. Body Design: Two piece.
 - c. Body Material: Forged brass or bronze.
 - d. Port Size: Full or standard.
 - e. Seat: PTFE.
 - f. Stem: Bronze or stainless steel.
 - g. Ball: Chrome-plated brass.
 - h. Actuator: Hand-lever.
- B. Globe Valves:
 - 1. Description:
 - a. Pressure Rating: 175 psig (1200 kPa).
 - b. Body Material: Bronze with integral seat and screw-in bonnet.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc Holder and Nut: Bronze.
 - f. Disc Seat: Nitrile.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Confirm valve interior to be free of foreign matter and corrosion.
- B. Remove packing materials.
- C. Examine guides and seats by operating valves from the fully open position to the fully closed position.
- D. Examine valve threads and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage.
 - 1. Check bolting for proper size, length, and material.
 - 2. Verify gasket for size, defects, damage, and suitable material composition for service.
 - 3. Replace all defective valves with new valves.

3.02 INSTALLATION

- A. Comply with specific valve installation requirements and application in the following Sections:
 - 1. Section 211300 for application of valves in wet and dry pipe, fire-suppression sprinkler systems.
- B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
 - 1. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in water supply connections and backflow preventer at potable water supply connections.
- D. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.
- E. Valves in horizontal piping installed with stem at or above the pipe center.
- F. Position valves to allow full stem movement.
- G. Install valve tags. Comply with Section 210553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 210523

SECTION 210548
VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Seismic control requirements.

1.02 DEFINITIONS

- A. Fire Suppression Component: Where referenced in this section in regards to seismic controls, applies to any portion of the fire suppression system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
- D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- G. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3300 Submittal Procedures, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
- D. Seismic Design Data:

1. Compile information on project-specific characteristics of actual installed fire suppression components necessary for determining seismic design forces required to design appropriate seismic controls.
 2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- E. Evidence of qualifications for seismic controls designer.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide fire suppression component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor fire suppression components.
- B. Seismic Design Criteria: Obtain from project Structural Engineer of Record.
- C. Seismic Restraints:
 1. Provide seismic restraints for fire suppression components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.
 - e. FEMA E-74.
 - f. SMACNA (SRM).
 3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
 4. Seismic Restraint Systems:
 - a. Arrange restraint elements to avoid obstruction of sprinklers in accordance with NFPA 13.
 - b. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - c. Use only cable restraints to restrain vibration-isolated fire suppression components.
 - d. Use only one restraint system type for a given fire suppression component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - e. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain fire suppression component in all lateral directions; consider bracket geometry in anchor load calculations.

- f. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported fire suppression component weight.
 - g. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported fire suppression component weight.
 - h. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
 - i. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
 - j. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
- D. Seismic Attachments:
- 1. Comply with support and attachment requirements of NFPA 13.
 - 2. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
 - 3. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
 - 4. Do not use power-actuated fasteners.
 - 5. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps, but not for sway bracing attachments as prohibited by NFPA 13.
 - 6. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
- E. Seismic Interactions:
- 1. Include provisions to prevent seismic impact between fire suppression components and other structural or nonstructural components.
 - 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
 - 3. Comply with minimum clearance requirements between other equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.
- F. Seismic Relative Displacement Provisions:
- 1. Use suitable fittings or flexible connections, in accordance with NFPA 13, to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.
 - 2. Provide clearance around fire suppression system piping extending through walls, floors, platforms, and foundations in accordance with NFPA 13.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Secure fasteners according to manufacturer's recommended torque settings.
- C. Field-Welding (where approved by Architect): Comply with Section 055000.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

END OF SECTION 210548

**SECTION 211300
FIRE-SUPPRESSION SPRINKLER SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. Dry-pipe sprinkler system.
- C. Preaction sprinkler system.
- D. System design, installation, and certification.

1.02 RELATED REQUIREMENTS

- A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.
- B. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
- C. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- D. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- E. Section 284600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products Current Edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3300 Submittal Procedures for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- D. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- F. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.06 QUALITY ASSURANCE

- A. Comply with UL (DIR) requirements.
- B. Equipment and Components: Provide products that bear UL (DIR) label or marking.

- C. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.
 - 2. Viking Corporation; _____: www.vikinggroupinc.com/#sle.

2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Interface system with building control system.
- E. Provide fire department connections where indicated.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

- A. Suspended Ceiling Type: Concealed pendant type with matching push on cover plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- B. Exposed Area Type: Pendant type with guard.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- C. Sidewall Type: Recessed horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- E. Flexible Drop System: Stainless steel, multiple use, open gate type.
 - 1. Application: Use to properly locate sprinkler heads.
 - 2. Include all supports and bracing.
 - 3. Provide braided type tube as required for the application.
 - 4. Manufacturers:
 - a. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.

2.04 PREACTION VALVE CONTROL PANEL

- A. Provide a modular type control panel for electrically operated detection and extinguishing systems for each preaction valve.
 - 1. Factory mount in surface mounted, steel cabinet with hinged doors, and cylinder lock.
 - 2. Provide factory wired assembly containing components and equipment as required to perform specified system operating and supervisory functions.
 - 3. Include isolation switch to allow system testing without activation of the preaction valve.
 - 4. House batteries in separate and lockable, steel cabinet.
 - 5. Finish interior and exterior of cabinet with enamel paint and provide identification plates.

6. Include trouble lights and trouble alarm.
 7. Provide 120 volt AC service transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all system actuating, signal sounding, trouble signal, and fire alarm tripping circuits.
 8. Provide UL (DIR) listed as an extinguishing system releasing panel and separate from the building's fire alarm control panel.
- B. Secondary Power Supply:
1. Provide nickel cadmium, lead calcium, or sealed lead acid rechargeable storage batteries and battery charger.
 2. Storage Batteries:
 - a. Provide with sufficient ampere-hour rating to operate under supervisory and trouble conditions, including audible trouble signal devices under alarm conditions for an additional 10 minutes and as required in accordance with the equipment listing.
 - b. Prevent contact between terminals of adjacent cells, battery terminals, and other metal parts with separate cell construction.
 3. Battery Charger:
 - a. Provide solid-state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less.
 - b. Locate charger within control panel or battery cabinet.
- C. Wiring: Refer to Section 260583.

2.05 AIR COMPRESSOR

- A. Compressor: Single-unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Locate outside alarm gong on building wall per code and fire marshal..
- D. Place pipe runs to minimize obstruction to other work.
- E. Place piping in concealed spaces above finished ceilings.
- F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- H. Install air compressor on vibration isolators.
- I. Flush entire piping system of foreign matter.
- J. Install guards on sprinklers where indicated.
- K. Hydrostatically test entire system.
- L. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 211300

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**SECTION 212200
CLEAN-AGENT FIRE-EXTINGUISHING SYSTEM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire suppression system control panel.
- B. Space or area signage.
- C. System piping and specialties.
- D. Clean-agent containers.
- E. Agent discharge nozzles.

1.02 RELATED REQUIREMENTS

- A. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- B. Section 211300 - Fire-Suppression Sprinkler Systems.
- C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- D. Section 284600 - Fire Detection and Alarm: Building fire alarm system and devices.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2022).
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- C. ASME B31.1 - Power Piping 2022.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- E. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.
- F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- H. ITS (DIR) - Directory of Listed Products Current Edition.
- I. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- L. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems 2022, with Errata.
- M. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting section work; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Section 01 3300 Submittal Procedures for submittal procedures.
- B. Product Data: Provide system and component data bearing approval stamp from Authority Having Jurisdiction. Include detectors, release devices, discharge nozzles, manual controls, alarm devices, annunciators, extinguishing agent containers, manifolds, and control panel.
- C. Shop Drawings:
 - 1. Provide stamp of approval from Authority Having Jurisdiction.
 - 2. Floor Plan(s): System layout with proposed raceway, piping, and component locations with a minimum drawing scale of 1/8 inch to 1 foot (1:100), use larger scale for details.

3. Schematics: System riser, control and wiring diagrams with written sequence of operation.
- D. Design Data: Submit design calculations stamp of approval from Authority Having Jurisdiction. Include calculated system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.
- E. Manufacturer's Instructions: Include recommended equipment installation and system components.
- F. Test Reports: Indicate successful completion of tests; include certification of extinguishing agent container pressure and extinguishing agent quantity.
- G. Code Authority Approval: Submit copy of inspection approval of fire protection system by Authority Having Jurisdiction.
- H. Designer's qualification statement.
- I. Manufacturer's qualification statement.
- J. Installer's qualification statement.
- K. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.
- L. Operation and Maintenance Data:
 1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
 2. Include manufacturer recommended spare parts list.
 3. Include checklists and procedures for emergencies, troubleshooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.
- M. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- N. Maintenance Materials: Furnish the following for Owner's use;
 1. See Section 016000 - Product Requirements for additional provisions.
 2. Equipment Maintenance Tools: One set, including special tools necessary for servicing and maintaining the equipment installed.
 3. Extra Detectors: One of each type.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

1.08 WARRANTY

- A. See Section 01 7800 Warranties for additional warranty requirements.
- B. Provide two year system warranty for complete replacement fire extinguishing agent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ANSUL, a Tyco brand, Johnson Controls International, LLC; ____: www.ansul.com/#sle.
- B. Kidde Fire Systems, a Carrier Company; ____: www.kidde-fenwal.com/#sle.
- C. Pyro-Chem, a Tyco brand, Johnson Controls International, LLC; ____: www.pyrochem.com/#sle.

2.02 APPLICATIONS

- A. Server Room: Location of devices:
 - 1. Smoke Detector: One at ceiling.
 - 2. Heat Detector: Two at ceiling.
 - 3. Abort Switch: Next to main entrance, left side.
 - 4. Manual Release: Next to main entrance, right side.
 - 5. Alarm Bell: Any suitable location.

2.03 CLEAN-AGENT FIRE SUPPRESSION SYSTEM REQUIREMENTS

- A. Engineered fire detection and suppression system that totally floods protected area with clean-agent fire extinguishing agent to extinguish fire.
 - 1. Comply with NFPA 2001 and NFPA 72.
 - 2. Fire Extinguishing Agent: Any allowed by NFPA 2001.
 - 3. Locate extinguishing agent supply and backup supply in each protected area.
 - 4. Locate manual release stations at each exit from protected area.
 - 5. Locate abort stations at each exit from protected area.
 - 6. Provide all manufactured system components from a single source and by a single manufacturer.
 - 7. Provide components listed and labeled by ITS (DIR) or UL (DIR) for the type of system required and for use with the other components of the system.
 - 8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose specified and indicated.
 - 9. Permanently mark valves with manufacturer's name and pressure rating.
- B. Engineered System Design Criteria:
 - 1. Provide total flooding of fire extinguishing agent at manufacturer's recommended concentration by volume and initiated within 10 of automated fire detection or immediately upon manual station operation, supplied continuously for 10 minutes with 10 percent allowance for room leakage.
 - 2. Provide minimum of two zone circuits in each contiguous protected space.
 - 3. Direct discharge parallel to ceiling; use 360 degree pattern nozzles except where obstructions would make 360 distribution inefficient.
 - 4. Use UL-listed flow calculation software.
 - 5. Provide sufficient amount of fire extinguishing agent. Consider the following when computing volume:
 - a. Volume of protected area.
 - b. Specific volume of fire extinguishing agent.
 - c. Additional quantities of fire extinguishing agent required to compensate for openings, pipe losses.
 - d. Other special conditions affecting extinguishing agent concentration.

2.04 FIRE SUPPRESSION SYSTEM CONTROL PANEL

- A. Provide system controller in the form of fire alarm system monitored, self-contained control panel or module.
- B. Type: Combination type approved as both alarm and releasing device, with solid state internal circuitry enclosed in NEMA ICS 6, Type 1 cabinet.
- C. Provide NFPA 72, Class A circuit supervision for wire break or ground faults of:
 - 1. Zone detection loops.
 - 2. Suppression system solenoid valves.
 - 3. Power supply and circuit wiring and fuse.
 - 4. Battery interconnecting wires and fuse.
 - 5. Alarm in abort mode.
- D. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators.

- E. Equip panel with following standard features:
 - 1. Visual and audible annunciation of trouble or alarm signals.
 - 2. Panel reset switch.
 - 3. Trouble alarm silence switch with ring back feature.
 - 4. Battery test meter and switch.
 - 5. Manual discharge switch.
 - 6. Deadman abort switch.
 - 7. Programmable timers for pre-discharge and discharge, 0 to 60 second cycle.
 - 8. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
 - 9. Relay contactors for general trouble signal.
 - 10. Relay contactor activated by detector zone board in alarm or trouble mode.
- F. Annunciation: Provide the following annunciation:
 - 1. Power On: Green.
 - 2. System Trouble: Amber.
 - 3. Battery Trouble: Amber.
 - 4. Ground Fault: Amber.
 - 5. Release trouble: Amber.
 - 6. Agent Release: Red.
 - 7. Alarm Output Trouble: Amber.
 - 8. Supervisory Trouble: Amber.
- G. Batteries: Provide nickel cadmium batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 24 hours. Provide automatic battery switch-over upon failure of primary power supply.
- H. BAS, BMS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet IP.
- I. Initiating Devices:
 - 1. Manual Pull Stations:
 - a. Semi-flush housing fitted with double action control fitted with "push in" tab and "pull down" lever that locks in position after releasing spring-loaded contact switch, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
 - 1) Activate all audible and visual alarms.
 - 2) Override any abort station or time delay function.
 - 3) Activate all release and shutdown functions normally triggered by detectors or alarm system.
 - 4) Engraved Sign or Label: Provide adjacent to each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.
 - 2. Manual System Abort Switch:
 - a. Stainless steel plate with momentary contact push button, countdown timer, magnetic door holders manual release, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
 - b. Engraved Sign or Label: Provide adjacent to each manual abort station, indicating area protected and that actuation will prevent discharge of fire extinguishing agent after automatic system is activated.
 - 3. Ionization Smoke Detectors:
 - a. UL (DIR) listed, NFPA 72, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.
 - b. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.
 - c. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, 24 volts. On alarm, unit shall lock and be reset at control panel.
 - d. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.

- e. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.
- 4. Photoelectric Smoke Detectors:
 - a. UL (DIR) listed, NFPA 72, adjustable sensitivity, with LED light source including photocell, activated by smoke, plug-in, twist-lock unit easily removed from base.
 - b. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.
 - c. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
 - d. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.
- 5. Heat Detectors:
 - a. UL (DIR) listed, NFPA 72, micro-processor based, thermistor type, that responds to a fixed temperature with minimal thermal lag.
 - b. Electronically Addressable and Field Programmable: Resettable alert and alarm thresholds provide real-time value of current and local temperature when requested by operator.
 - c. Configuration Option: Prevention of inadvertent or spurious fire signatures from accidental discharge of agent via programmable alarm threshold.
- J. Notification and Control Devices:
 - 1. Alarm Bells: 24 VDC with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet (3 m), for mounting on 4 inch (100 mm) electrical outlet box.
 - 2. Alarm Horns: 24 VDC with supervision of circuit wiring, with minimum sound level of 90 dba at 10 feet (3 meters), for mounting on 4 inch (100 mm) electrical outlet box.
 - 3. Strobe Beacon: 24 VDC with system identification on strobe lens.
- K. Fire-Suppression Operating Sequence:
 - 1. Actuation of one detector in either zone circuit:
 - a. Illuminate zone indicator.
 - b. Energize alarm bell.
 - c. Shut down air-conditioning system and close dampers.
 - d. Close doors to area.
 - e. Signal building fire alarm system.
 - 2. Actuation of second detector on second zone circuit:
 - a. Illuminate zone indicator.
 - b. Energize alarm horn.
 - c. Shut down power to protected equipment.
 - d. Actuate time delay for up to 30 seconds.
 - e. Release extinguishing agent into protected area.
 - f. If abort switch is engaged, delay release.
 - g. Upon abort switch disengagement release extinguishing agent unless system cleared and reset.
 - 3. Discharge of Extinguishing Agent:
 - a. Sounds alarm bells and horns.
 - b. Operates strobes.
 - 4. Temperature Detection:
 - a. Lower Temperature: Illuminate indicator and energize bell.
 - b. Higher Temperature: Shut down power to protected equipment.
 - c. High Temperature Detection: Close circuit to sprinkler pre-action valve.

2.05 SPACE OR AREA SIGNAGE

- A. Entrance Warning Sign: One warning sign at each entrance to protected area.
- B. Exit Warning Signs: One lighted, flashing warning sign at each exit from protected area.

2.06 SYSTEM PIPING AND SPECIALTIES

- A. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, or ASTM A135/A135M Schedule 10, galvanized as specified in ASTM A53/A53M.
 - 1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch (50 mm) and smaller, or ASTM A234/A234M, wrought steel welding type fittings.
 - 2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.
- B. Pipe Hangers: ASME B31.1, UL (DIR) approved listing for sprinkler systems, split clamp up to 2-1/2 inch (60 mm) size, riser clamps over 2-1/2 inch (60 mm) size, adequate to offset discharge thrust.
- C. Seismic Restraint Devices: Provide pipe hangers and isolators, see Section 210548.
- D. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches (50 mm) larger than opening.

2.07 CLEAN-AGENT CONTAINERS

- A. Containers:
 - 1. Steel, red enamel finish; standard model and size for ease of replacement and addition.
 - 2. Where multiple, replaceable containers are used, provide only containers of the same size and holding the same amount of extinguishing agent.
- B. Contents: Fill with required fire extinguishing agent.
- C. Identification: Permanent plate or marking, specifying agent, tare and gross weight, pounds of fire extinguishing agent, and pressurization level; installed so plate or marking is visible and readable.
- D. Actuator: Resettable electric or pneumatic with pressurized nitrogen cartridge. Explosive devices are NOT permitted.
- E. Pressure Gauge: Visual indicator of internal pressure.
- F. Low Pressure Switch: Electronic sensor; reports to control panel and provides audible and visual alarms when container pressure drops below 230 psi (1586 kPa).
- G. Manifold: Provide for systems with more than one container, with rack to secure each and check valves between each discharge and manifold.

2.08 AGENT DISCHARGE NOZZLES

- A. Nozzles: UL (DIR) listed; orifice size providing required rates of discharge and coverage and to distribute extinguishing agent uniformly throughout protected area.
- B. Construction: Two-piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body; one-piece deflector plate.
- C. Identification: Permanently mark nozzles with manufacturer's part number, UL listing and equivalent single orifice diameter.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that enclosing walls are continuous above ceilings and below raised floors to enable required concentration to be built up and maintained for required time to ensure fire is extinguished.

3.02 INSTALLATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.
- B. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.

- C. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.
- D. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.
- E. Install unions downstream of valves and at equipment or apparatus connections.
- F. Identify in accordance with requirements of referenced standard.
- G. Containers: Mount and anchor as indicated on drawings.
- H. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot (1.2 m) radius of the nozzles to prevent lifting during discharge.
- I. Install wiring in compliance with NFPA 70, see Section 260583.
- J. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.
- K. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.
- L. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.
- M. Mounting Height of Notification Devices: Between 72 to 80 inches (86.5 to 203.2 cm) above finished floor.
- N. Locate extinguishing agent supply and backup supply in each protected area.
- O. Locate manual release at each exit from protected area.
- P. Locate strobe units at points of entrance to each protected area.
- Q. Locate abort station at points of exit from each protected area.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Integrate the system with pre-action sprinkler system, see Section 211300.
- B. Provide auxiliary alarm and trouble/fault signals to fire alarm system for supervisory monitoring, see Section 284600.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.
- B. Test distribution piping and valving, prior to nozzle installation, to 50 psi (340 kPa) air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.
- C. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.
- D. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.
- E. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.
- F. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.
- G. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.

3.05 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with the controls system.

END OF SECTION 212200

**SECTION 220100
GENERAL PLUMBING CONDITIONS**

PART 1 GENERAL

1.01 SUMMARY

- A. This section covers the general requirements for all of Division 22- Plumbing scope of work.
- B. See Division 01 for additional administrative requirements whether specifically callout out or not in this Division. Reference other Divisions as needed for additional requirements.
- C. The work of Division 22 consists of providing all labor, products, coordination, and of performing all operations required for the complete operating installation of all plumbing systems as specified, in strict accordance with this and all sections of these specifications, applicable drawings, terms, and conditions of the contract, and all applicable codes and ordinances governing installation of the various plumbing systems. Coordinate all work fully with the work of other crafts along with providing operation and maintenance clearances as required or recommended by the manufacturer of the equipment. Provide all systems complete and in proper operating order. This section of Division 22 is a part of all other sections of Division 22.

1.02 RELATED DOCUMENTS

- A. Work under entire Division 22 of the Specifications shall be subject to the General Conditions and Supplementary General Conditions as presented in the Architectural sections.
- B. The requirements of the architectural sections apply to all work of this and all other sections. Anything called for on either the drawings or in the specifications shall form a part of the contract documents as if called out in both.
- C. See Division 23 for Natural Gas.
- D. If any conflict occurs between the rules of governing agencies and this Specification, the more restrictive is to govern (as interpreted by the architect). Nothing in these drawings and specifications shall be construed to permit work not conforming with the governing codes and Authorities Having Jurisdiction. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the before mentioned governing agencies and not contrary to same.

1.03 ABBREVIATIONS AND DEFINITIONS

- A. When the following abbreviations and definitions are used in relation to the work for Division 22 they shall have the following meanings:
 - 1. Accepted Reviewed with no exceptions taken to submittal material.
See "Submittal" below.
 - 2. AHJ Authorities Having Jurisdiction
 - 3. Approved Inspected and accepted by the Authorities having
Jurisdiction and Engineer.
 - 4. Architect Architect or their representatives.
 - 5. Architectural Drawings Architectural or Interior Drawings
 - 6. ASTM American Society for Testing Material
 - 7. Code All codes in force for the project and AHJ. If the contract
documents denote work in excess of the codes, the
Contractor shall install this work per the contract
documents as long as code is not violated by his doing so.
 - 8. Contractor The Plumbing Contractor.
 - 9. Engineer Engineer of Record for the discipline
 - 10. Exterior Outside of or penetrating the outer surfaces of the building
weather protective membrane.
 - 11. F&I Furnish and install complete with all needed accessories
 - 12. Fully Operational Tested and approved and operating to the satisfaction of
the AHJ, manufacturer, contract documents, Architect and
Engineer.
 - 13. GC General Contractor

14. Provide, Furnish, Install, Supply	Purchase, deliver to the jobsite, install and make fully Operational.
15. Mfr.	Manufacturer
16. Noted	Shown or specified on or in the contract documents
17. Owner	Owner or his representatives
18. Required	As required by code, AHJ, Architect, Engineer, contract documents for the particular installation, and in addition, all items needed to be fully operational (in the Architect's and Engineer's opinion).
19. Shop Drawing	AutoCAD (or Revit) drafted document which fully details and dimensions the equipment and intended installation relative to this specific project. Manufacturer's "catalog" drawing is not acceptable. Provide an AutoCAD compatible file with shop drawing. Scale shall be indicated on drawing.
20. Shown	As indicated on the drawings or details or specified or needed to be fully operational.
21. Submittal	Any material for Engineer review which may contain catalog cuts, shop drawings, wiring diagrams, etc., of the actual material being furnished.
22. Whichever is more stringent	Whichever is more stringent in the opinion of the Engineer.

1.04 CONSTRUCTION DRAWINGS AND SPECIFICATIONS

- A. Construction Drawings and Specifications shall be provided by the owner or their representative for use of the contractor during construction. These drawings are conceptual, diagrammatic and intended to provide a basis of design and detailed direction to contractors during the bidding, subsequent coordination, and finalization of installed component process. They will also provide the functional targets and owner's expectations for all systems installed at the facility. Drawings that depict actual pipe routing, hanging methods, coordination with structural and other trades are all in the purview of the plumbing contractor in the form of Pre-Construction Shop Drawings. For additional details, the Contractor is referred to the site and to the Architectural and other trade drawings. If perceived errors, omissions, or conflicts between the above drawings and/or Specifications occur, the Contractor shall obtain clarification from the Architect prior to bidding.
- B. All working measurements shall be taken from the actual field dimensions and verified against those shown on the construction drawings, and if they are found to vary from the latter, the Contractor shall report the same to the Architect at once and make adjustment before proceeding with this portion of his work. This shall not be construed as a "stop work" order. Failure to comply with this instruction shall result in the Plumbing Contractor being required to alter the work at the direction of the Architect and at the Plumbing Contractor's expense.
- C. The construction drawings or the specifications may be supplemented from time to time by diagrams from the Architect and/or details as required for the proper understanding, execution and completion of the work, and all such additional drawings shall be considered as forming a part of the contract at no additional charge from the contractor. Drawings of a later date shall always have precedence over previous drawings.

1.05 SHOP DRAWINGS

- A. As part of the submittal process and prior to the commencement of construction or installation of systems, the contractor shall provide shop drawings as defined herein for review and approval by the mechanical engineer and commissioning authority.
 - 1. Proposed coordinated locations and orientations of all installed plumbing equipment.
 - 2. Proposed and resultant service and code required clearance dimensions and access points for all plumbing equipment.
 - 3. Proposed pipe routing, offsets, location, support points, and termination points.

4. Proposed bottom of pipe (BOP) and piping dimensions above finished floors.
5. Proposed slopes of drainage piping.
 - a. Proposed hanger and support system details including distances between hangers or supports for piping.
 - b. If not already addressed in the construction plans and specifications, limitations and manufacturer's recommended installation practices for proposed products or installation methods that differ from those indicated in the construction documents. Limitations shall include but not be limited to pressure or velocity high and low thresholds, acceptable temperature ranges, restrictive installation practices, and flame and structural tolerances for installation in all proposed locations such as ceilings, concealed spaces or exposed locations.

1.06 CONSTRUCTION PHASE CONTRACTOR DRAWINGS:

- A. The Plumbing Contractor shall provide a set of red-lined Contractor Drawings on site during the construction phase of the project that shall notate and depict changes in systems routing, points of connection, sizes and capacities, substitutions, and deviations from the construction plans that have been executed during the construction phase. Additions and changes in drawings shall be indicated by clouds with date of notation or entry. These Drawings shall be available for viewing by the GC, Mechanical EOR and Architect as requested.

1.07 AS-BUILT DRAWINGS:

- A. At the completion of work and as part of the closeout documentation the contractor shall provide 2 sets of hard copies and a complete electronic file of all drawings in PDF format with legible and accurate redline changes submitted for approval. These drawings shall include but not be limited to the following requirements:
 1. Plans of the original construction (or shop) drawing set with legible redlines.
 2. Location of all valving and plumbing equipment and devices that require servicing.
 3. Service access points of all installed plumbing equipment.
 4. Equipment schedule changes where approved substitutions occurred. Schedule notations for approved alternates shall include all schedule fields.

1.08 CODES AND ORDINANCES

- A. Work shall comply with all applicable federal, state, county and local codes, ordinances and policies, the contract documents, and AHJ. Contractor shall make application and pay for any needed or required inspections and permits, drawing reviews, and all other items. Compliance with the above shall be at the Plumbing Contractor's expense and at no additional charge. Field changes and/or code corrections required by AHJ shall be made at the Plumbing Contractor's expense.

1.09 SUBMITTALS

- A. See Section 01 3300 for submittal procedures and additional requirements.
- B. Product Submittals:
 1. Submit documents per all requirements of the Architectural sections in addition to this section.
- C. Plumbing Equipment Product Submittals:
 1. A complete equipment list by specification section of the equipment proposed to be installed, stating the type of equipment and its major components by make, model number, manufacturer, and giving full performance data. Provide bookmarked and tagged PDF submittals – non tagged submittals shall not be reviewed and shall be returned for correction.
 - a. Identify the specific product. When more than one size or type of item appears in shop drawings or catalog sheets, the item being submitted shall be identified by arrow, underlining or highlighting and all data not applicable shall be crossed out.
 - b. Partial submittals:
 - 1) Partial material submittals and/or product submittals will not be considered unless specifically requested by the Mechanical Engineer, Commissioning Authority or Architect.

- c. Submittal format and prior approvals:
 - 1) Submittals shall be neatly bound and indexed with Contractor's name, address, and phone number on cover – including the names and contact information equipment supplier, manufacturer, and sub-Contractors associated with each product. Product categorization and identification shall match exactly the identification indicated on plans, schedules and specifications.
 - 2) Submittals shall have the General Contractors approval on the cover sheet indicating they have reviewed the submittal and any coordination between contractors has already occurred.
- D. Contractor's Comprehensive Responsibility
 - 1. Review of Pre-Construction Shop Drawings or Field Generated Shop Drawings by the Architect or Mechanical EOR shall not relieve the Contractor from being fully responsible for all information contained therein as well as in the Construction Drawings and Specifications. This is also the case for the contractor developed Shop Drawings which impact the jobsite conditions, space requirements, performance requirements, weight, plumbing and electrical requirements. Contractor shall note drawings are reviewed by the Engineer in meeting "Design Concept" only. The Architect's or Engineer's review shall not absolve the Contractor of their responsibility for conditions and intent of the contract documents.
- E. Unauthorized Procurement or Fabrication
 - 1. Without prior and product-specific approval to order or fabricate, no procurement or fabrication of products shall be done until return of submittals and all submittal review responses have been accepted and approved by the mechanical engineer of record.
- F. Substitutions:
 - 1. See the architectural sections for substitution requirements. If unapproved substitute equipment is installed, the Contractor shall be responsible for the engineering cost associated with review and possible redesign. After review, the engineer shall reserve the right to reject the unapproved, installed substitute and require the contractor to remove and install per the original design. All costs for engineering review and possible reinstallation shall be borne by the contractor.

1.10 OPERATION AND MAINTENANCE MANUALS

- A. Contents:
 - 1. Furnish three (3) bound copies of operating and maintenance manuals to include the following:
 - a. Manufacturers, suppliers, contractor and plumbing sub contractors' names, addresses and phone numbers.
 - b. Warranty service contractors' names, address and phone numbers (if different from above).
 - c. Schedule and description of routine maintenance for each component.
 - d. Manufacturer's cuts and rating tables, including brochures for all submittal items.
 - e. Part numbers of all replaceable items.
 - 1) Control diagrams and operation sequence.
 - f. Written guarantees.
 - g. Record drawings corrected and completed.
- B. Binders:
 - 1. Furnish typewritten or printed index and tabbed dividers between principal categories.
 - 2. Bind each manual in a hard-backed loose-leaf binder.
 - 3. Imprint on Cover: Name of job, Owner, location of job, Architect, Engineer, Contractor, year of completion
 - 4. Imprint on Cover: Name of job, year of completion

1.11 WARRANTY

- A. Contractor to warrant equipment, labor and installation for one (1) year from date of substantial completion and acceptance by owner. See 017800 for additional requirements.

- B. Where Drawings or other Technical Specification Sections refers to a conflicting length of warranty or starting date for the Contractor's or subcontractor's general material and workmanship warranty, the longer period shall govern.

1.12 PERMITS AND FEES:

- A. The Contractor shall make all arrangements and pay all fees prior to making any connections to utilities and conform to regulations concerning such connections to said utilities. Contractor shall submit copies of signed, approved permits to the Architect upon request. Contractor shall properly protect and support all water, sewer, electric and other services, shall immediately notify bodies owning the same, granting them the opportunity to take such precautions, as they may see fit, and be responsible for all damage to the same caused by his operation.

END OF SECTION 220100

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SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

- A. Section 078413 Penetration Firestopping.
- B. Section 099113 - Exterior Painting: Preparation and painting of exterior piping systems.
- C. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. FM (AG) - FM Approval Guide Current Edition.
- D. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.
- C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- D. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
 - 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

- A. Manufacturers:
 - 1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
 - 2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
 2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.
- C. Pipe Sleeve Material:
1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
 2. Masonry Structures: Sheet metal or fiber.
- D. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Structural Considerations: Do not penetrate building structural members unless indicated.
- E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces. Also fill where transitions occur between plenum and non-plenum spaces.
 3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with code to prevent the spread of fire, smoke, and gases.
 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- F. Manufactured Sleeve-Seal Systems:
 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 220517

SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Angle valves.
- B. Ball valves.
- C. Check valves.
- D. Flow limiting valves.
- E. Gate valves.
- F. Globe valves.

1.02 RELATED REQUIREMENTS

- A. Section 083113 Access Doors and Fre.
- B. Section 220553 - Identification for Plumbing Piping and Equipment.
- C. Section 220719 - Plumbing Piping Insulation.
- D. Section 221005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. TFE: Tetrafluoroethylene.
- I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- C. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.
- D. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- E. MSS SP-45 - Drain and Bypass Connections 2020.
- F. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- G. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- H. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- I. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.05 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.06 QUALITY ASSURANCE

- A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Use the following precautions during storage:
 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- C. Provide the following valves for the applications if not indicated on drawings:
 1. Shutoff: Ball, butterfly, gate or plug.
 2. Dead-End: Ball Valve
 3. Swing Check (Pump Outlet):
 - a. 2 inch (50 mm, DN) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
- D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- E. Required Valve End Connections for Non-Wafer Types:
 1. Copper Tube:
 - a. 2 inch (50 mm, DN) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. 2-1/2 inch (65 mm, DN): Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
- F. Domestic, Hot and Cold Water Valves:
 1. 2 inch (50 mm, DN) and Smaller:
 - a. Bronze and Brass: Provide with solder-joint ends.
 - b. Bronze Angle: Class 125, bronze disc.
 - c. Ball: One piece, full port, brass with brass trim.
 - d. Bronze Swing Check: Class 125, bronze disc.
 - e. Bronze Gate: Class 125, NRS.
 - f. Bronze Globe: Class 125, bronze disc.
 2. 2-1/2 inch (65 mm, DN) and Larger:
 - a. Iron, 2-1/2 inch (65 mm, DN) to 4 inch (100 mm, DN): Provide with threaded ends.
- G. Sanitary Waste Water Valves (Elevator Sump Pump Discharge Line or Pressurized Waste (PW)):
 1. 2 inch (50 mm, DN) and Smaller:
 - a. Schedule 40 PVC or bronze and Brass: Provide with threaded ends and appropriate couplings for dissimilar materials.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures. Include industry standard safety factors.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Insulated Piping Valves: With 2 inch (50 mm, DN) stem extensions and the following features:
 1. Gate Valves: Rising stem.

2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: Extended neck.
- D. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
 2. Solder Joint Connections: ASME B16.18.
- E. Potable Water Use:
1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- F. Valve Bypass and Drain Connections: MSS SP-45.

2.03 BRONZE, ANGLE VALVES

- A. Class 125; CWP Rating: 200 psi (1,380 kPa):
1. Comply with MSS SP-80, Type 1.
 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 3. End Connections: Pipe thread.
 4. Stem: Bronze.
 5. Disc: Bronze.
 6. Packing: Asbestos free.
 7. Handwheel: Malleable iron, bronze, or aluminum.

2.04 BRASS, BALL VALVES

- A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
1. Comply with MSS SP-110.
 2. CWP Rating: 200 psi (1,379 kPa).
 3. Body: Forged brass.
 4. Seats: PTFE.
 5. Stem: Brass.
 6. Ball: Chrome-plated brass.
 7. Operator: Handle.
- B. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:
1. Comply with MSS SP-110.
 2. WSP Rating: 150 psi (1,035 kPa).
 3. WOG Rating: 200 psi (1,379 kPa).
 4. Body: Forged brass.
 5. Seats: PTFE.
 6. Stem: Brass.
 7. Ball: Chrome-plated brass.
 8. Operator: Lockable handle, memory stop and/or stem extension if application requires.
- C. Two Piece, Full Port with Press Connections:
1. WOG Rating: 250 psi (1,724 kPa).
 2. Body: Forged brass.
 3. Seats: EPDM.
 4. Ball: Chrome-plated brass.
 5. Blow-out Proof Stem: Forged brass.
 6. Operator: Provide lockable handle.
 7. Maximum Service Temperature: 250 degrees F (121.1 degrees C).

2.05 BRONZE, BALL VALVES

- A. General:
1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.

- B. One Piece, Reduced Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 400 psi (2,760 kPa).
 - 3. CWP Rating: 600 psi (4,140 kPa).
 - 4. Body: Bronze.
 - 5. End Connections: Pipe press.
 - 6. Seats: PTFE.
- C. Two Piece, Full Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi (1,035 kPa).
 - 3. WOG Rating: 250 psi (1724 kPa).
 - 4. Body: Forged bronze or dezincified-brass alloy.
 - 5. Ends Connections: Pipe thread or solder.
 - 6. Seats: PTFE.
 - 7. Stem: Bronze, blowout proof.
 - 8. Ball: Chrome plated brass.
 - 9. Operator: Provide lockable handle and stem extension.

2.06 BRASS, INLINE CHECK VALVES

- A. Class 150:
 - 1. WOG Rating: 200 psi (1,380 kPa).
 - 2. Maximum Service Temperature: 250 degrees F (121.1 degrees C).
 - 3. Body: Forged brass.
 - 4. Disc: Forged brass.
 - 5. Seal: PTFE, bubble-tight.
 - 6. End Connections: Press or soldered.

2.07 BRASS, HORIZONTAL SWING CHECK VALVES

- A. Class 125, Threaded End Connections:
 - 1. WOG Rating: 200 psi (1,380 kPa).
 - 2. Body: Forged brass.
 - 3. Disc: Forged brass.
 - 4. Hinge-Pin, Screw, and Cap: Forged brass.

2.08 BRONZE, SWING CHECK VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
 - 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 - 2. Design: Y-pattern, horizontal or vertical flow.
 - 3. WOG Rating: 200 psi (1,380 kPa).
 - 4. Body: Bronze, ASTM B62.
 - 5. End Connections: Threaded.
 - 6. Disc: Bronze.

2.09 BRONZE, GATE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.10 BRONZE, GLOBE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Lift Check: Install with stem plumb and vertical.
 - 2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION 220523

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**SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe supports, guides, shields, and saddles.
- E. Nonpenetrating rooftop supports for low-slope roofs.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2022).
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- M. UL (DIR) - Online Certifications Directory Current Edition.
- N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Vibration Isolation and Seismic Restraint Requirements: See Section 220548.
- F. Materials for Metal Fabricated Supports: Comply with Section 055000.
 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
 1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

- A. Strut Channels:
 1. Manufacturers:
 - a. Unistrut, a brand of Atkore International Inc; _____: www.unistrut.com/#sle.
 - b. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
 2. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
 3. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
 1. Threaded zinc-plated steel unless otherwise indicated.
 2. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm, DN) diameter.
 - b. Piping up to 1 inch (25 mm, DN): 1/4 inch (6 mm, DN) diameter.
 - c. Piping larger than 1 inch (25 mm, DN): 3/8 inch (10 mm, DN) diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.

2.03 BEAM CLAMPS

- A. Manufacturers:
 1. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.

2. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2.04 PIPE HANGERS

- A. Band Hangers, Adjustable:
 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 2. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
- B. Clevis Hangers, Adjustable:
 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
 3. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
 4. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
 5. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.05 PIPE CLAMPS

- A. Riser Clamps:
 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
 3. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 4. UL (DIR) listed: Pipe sizes 1/2 to 8 inch (15 to 200 mm, DN).

2.06 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Pipe Shields for Insulated Piping:
 1. Manufacturers:
 - a. Anvil International; _____: www.anvilintl.com/#sle.
 2. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
 3. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
 - d. Service Temperature: Minus 40 to 178 degrees F (Minus 40 to 81 degrees C).
 - e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- C. Pipe Supports:
 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
 2. Liquid Temperatures Up to 122 degrees F (50 degrees C):
 - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
 - b. Support From Below: MSS SP-58 types 35 through 38.
 3. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):
 - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
 - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
 - c. Sliding Support: MSS SP-58 types 35 through 38.
- D. Copper Pipe Supports:
 1. Manufacturers:

- a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
- b. Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by single manufacturer.

2.07 SEISMIC BRACING HARDWARE

- A. Cable Suspension Systems:
 - 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 - 2. Strut channel or bracket-fitted fitting with locking mechanism for pipe or equipment suspension using cable wires extended to surface-mounted end-fixing fittings.
 - 3. Provide cable wire and end-fixing as required to hold minimum weight of 120 lb (54.4 kg).

2.08 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

- A. Manufacturers:
 - 1. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 - 2. Unistrut, a brand of Atkore International Inc; _____: www.unistrut.com/#sle.
- B. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
- C. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
- D. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
- E. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 220529

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Nameplates:
 - 1. Control panels, transducers, and other related control equipment products.
- B. Tags:
 - 1. Piping: 3/4 inch (20 mm) diameter and smaller.
- C. Pipe Markers: 3/4 inch (20 mm) diameter and higher.

2.02 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch (6 mm).
 - 3. Background Color: Black.
 - 4. Nameplate Material:
 - a. Flexible: Vinyl with adhesive backing per ASTM D709.
 - b. Metal: Brass with center-side holes for screw fastening.

2.03 TAGS

- A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch (40 mm) in diameter.
- B. Metal: Brass, 19 gauge 1-1/2 inch (40 mm) in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.
- C. Piping: 3/4 inch (20 mm) diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.04 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.
- C. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- D. Identification Scheme, ASME A13.1:
 - 1. Primary: External Pipe Diameter, Uninsulated or Insulated.
 - 2. Secondary: Color scheme per fluid service.
 - a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

END OF SECTION 220553

**SECTION 220719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass fiber insulation.
- B. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 078413 Penetration Firestopping.
- B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. Johns Manville Corporation; _____: www.jm.com/#sle.
 - 2. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.

- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm (0.029 ng/(Pa s m)).
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

END OF SECTION 220719

**SECTION 221005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet (1500 mm) of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, buried within 5 feet (1500 mm) of building.
- D. Domestic water piping, above grade.
- E. Storm drainage piping, buried within 5 feet (1500 mm) of building.
- F. Storm drainage piping, above grade.
- G. Natural gas piping, above grade.
- H. Pipe flanges, unions, and couplings.
- I. Pipe hangers and supports.
- J. Pipe sleeve-seal systems.
- K. Flow-balancing valves.
- L. Pressure reducing valves.
- M. Strainers.

1.02 RELATED REQUIREMENTS

- A. Section 083113 Access Doors and Frames.
- B. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 220553 - Identification for Plumbing Piping and Equipment.
- D. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- D. ASME B31.1 - Power Piping 2022.
- E. ASME B31.9 - Building Services Piping 2020.
- F. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- I. ASTM B32 - Standard Specification for Solder Metal 2020.
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.

- O. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings 2020.
- P. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings 2020.
- Q. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- R. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- S. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
- T. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- U. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2023.
- V. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing 2023a.
- W. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.
- X. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- Y. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.
- Z. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential 1989.
- AA. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- BB. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- CC. NSF 372 - Drinking Water System Components - Lead Content 2022.
- DD. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe 2021.

1.04 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.
- B. Do not install any combustible materials within the return air plenum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: CISPI 301, hubless.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
 - 1. Manufacturers:
 - a. Uponor, Inc; _____: www.uponorengineering.com/#sle.
 - 2. PPI TR-4 Pressure Design Basis:
 - a. 160 psig (1102 kPa) at maximum 73 degrees F (23 degrees C).
 - 3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
 - 4. Joints: ASTM F1960 cold-expansion fittings.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Pipe: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Viega LLC; _____: www.viega.us/#sle.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.08 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

2.09 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch (80 mm, DN) and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

- B. Flanges for Pipe Sizes Over 1 inch (25 mm, DN):
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. No-Hub Couplings:
 - 1. Testing: In accordance with ASTM C1277 and CISPI 310.
 - 2. Gasket Material: Neoprene complying with ASTM C564.
 - 3. Band Material: Stainless steel.
 - 4. Eyelet Material: Stainless steel.
- D. Shielded, Heavy Duty No-Hub Couplings:
 - 1. Testing: In accordance with ASTM C1540 and FM 1680.
 - 2. Gasket Material: Neoprene complying with ASTM C564.
 - 3. Band Material: Stainless steel.
 - 4. Eyelet Material: Stainless steel.
- E. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.10 PIPE HANGERS AND SUPPORTS

- A. See Section 220529 for additional requirements.
- B. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
- C. Plumbing Piping - Drain, Waste, and Vent:
 - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
 - 3. Wall Support for Pipe Sizes to 3 inch (80 mm, DN): Cast iron hook.
 - 4. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Over: Welded steel bracket and wrought steel clamp.
- D. Plumbing Piping - Water:
 - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Cold Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
 - 3. Wall Support for Pipe Sizes Up to 3 inch (80 mm, DN): Cast iron hook.
 - 4. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.11 FLOW-BALANCING VALVES

- A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi (24 kPa).

2.12 PRESSURE REDUCING VALVES

- A. Manufacturers:
- B. 2 inch (50 mm, DN) and Larger:
 - 1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
 - 2. Pressure Reducing Pilot-Operator:

- a. Operating Range: 5 to 50 psi (0.35 to 35 Bar).
- b. Connected into brass or bronze pilot piping and fittings.
- c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.13 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc; _____: www.armstronginternational.com/#sle.
- B. Size 1/2 inch (15 mm, DN) to 3 inch (80 mm, DN):
 - 1. Class 150, threaded forged bronze Y-pattern body, stainless steel perforated mesh screen with cap, and rated for 150 psi (1,034 kPa), 250 deg F (121.1 deg C) WOG service.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 083113.
- I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
- L. Install valves with stems upright or horizontal, not inverted. See Section 220523.
- M. Excavate, bed, and backfill per code and other specification sections.
- N. Install water piping to ASME B31.9.
- O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- P. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- Q. Sleeve pipes passing through partitions, walls, and floors.
- R. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches (300 mm) of each horizontal elbow.

4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 5. Support vertical piping at every every floor. Support riser piping independently of connected horizontal piping.
 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 7. Provide copper plated hangers and supports for copper piping.
 8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 9. Provide hangers adjacent to motor-driven equipment with vibration isolation.
 10. Support cast iron drainage piping at every joint.
- S. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Provide spring-loaded check valves on discharge of water pumps.
- E. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 FIELD TESTS AND INSPECTIONS

- A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.
- B. Domestic Water Systems:
 1. Perform hydrostatic testing for leakage prior to system disinfection.
 2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
 3. General:
 - a. Fill the system with water and raise static head to 10 psi (345 kPa) above service pressure. Minimum static head of 50 to 150 psi (345 to 1,034 kPa). As an exception, certain codes allow a maximum static pressure of 80 psi (551.6 kPa).
- C. Gas Distribution Systems:
 1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
 2. General Systems:
 - a. Inject a minimum of 10 psi (68.9 kPa) of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
 - b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound (0.45 kg).
- D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

3.08 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

END OF SECTION 221005

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**SECTION 221006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cleanouts.
- B. Backflow preventers.
- C. Water hammer arrestors.
- D. Relief valves.
- E. Air vents.

1.02 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 223000 - Plumbing Equipment.
- C. Section 224000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

- A. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- B. NSF 372 - Drinking Water System Components - Lead Content 2022.
- C. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.
- B. See the Plumbing Construction documents for scheduled items not listed herein.

2.02 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.

2.03 WATER HAMMER ARRESTORS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
 - 2. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
- B. Water Hammer Arrestors:
 - 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.04 RELIEF VALVES

- A. Manufacturers:
 - 1. ITT Bell & Gossett; _____: www.bellgossett.com/#sle.

- B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.05 AIR VENTS

- A. Manufacturers:
 - 1. ITT Bell & Gossett; _____: www.bellgossett.com/#sle.
 - 2. Taco, Inc; _____: www.taco-hvac.com/#sle.
- B. Washer Type:
 - 1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to all automatic valves and flush valves.

END OF SECTION 221006

SECTION 221313 – FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

- A. Testing by Manufacturer:
 - 1. Manufacturer shall test all materials as required by these Specifications and the standards referenced.
 - 2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specification requirements.
 - 3. No material shall be delivered until test results and certifications are in the possession of the Engineer.
 - 4. Engineer shall have free access to all testing and records pertaining to material to be delivered to the job site.
 - 5. The Engineer may elect to be present at any or all material testing operations.
- B. Joint tests are intended for qualification of joint design and shall be considered to be a qualification test to establish the adequacy of the manufacturer's joint design. The manufacturer shall certify that tests have been performed within the last year with pipes equivalent in size and design and that they have passed the test enumerated in the specifications. Tests may be waived for pipes of different strength class if joint design is the same as the pipe tested.
- C. Testing Before Acceptance:
 - 1. The Engineer may require that the first section of pipe, not less than 300 feet in length, installed by each of the Contractor's crews be tested in order to qualify the crew and/or the materials.
 - 2. Pipe laying shall not be continued more than an additional 300 feet until the first section has been tested successfully.
- D. Final Acceptance:
 - 1. Prior to final inspection all pipelines shall be flushed and cleaned and all debris removed.
 - 2. Before sewer lines are accepted, all lines shall be tested as specified herein.
 - 3. All lines shall be tested for leakage.
 - 4. Any corrections required shall be made at the expense of the Contractor and the line retested.

1.3 SUBMITTALS

- A. The Contractor shall submit the following to the Owner within ten calendar days of the award date of the contract, or as otherwise noted:
 - 1. Manufacturer's literature for all pipe, fittings, couplings, adapters, and other materials to be furnished for the project.
 - 2. Fusion machine operators shall have attended and successfully completed a training course sponsored by the pipe manufacturer. A written copy of such training certification shall be provided to the Engineer with the installation plan and schedule.

1.4 PROTECTION OF LIVE SEWERS

- A. All existing live sewers including septic tanks and drain fields shall remain in service at all times. Adequate provision shall be made for disposal of existing sewage flow if any existing sewers are damaged.
- B. Any damage to the existing system shall be repaired to a condition equal to or better than that existing prior to the damage at no cost to the Owner.
- C. The existing system is discharged through some sewers with flat grades and in some cases through lift stations. All water accumulating during construction shall be removed from the new sewers and shall not be permitted to enter the existing system. The Contractor will be required to flush out the existing lines and/or repair lift stations or other facilities if gravel, rocks or other debris are permitted to enter the existing lines.
- D. The physical connection to an existing manhole or sewer line shall not be made until so authorized by the City. This authorization will not be given until all upstream lines have been completely cleaned, all debris removed, and where applicable, a pipe temporarily placed in the existing channel and sealed.

1.5 USE OF SEWERS PRIOR TO COMPLETION

- A. The Owner hereby reserves the right to make use of any portion of the work prior to completion of the entire Contract without invalidating the Contract and without constituting acceptance of any of the work.

PART 2 - PRODUCTS

2.1 BEDDING MATERIALS

- A. Material conforming to WSDOT Standard 9-03.12(3).

2.2 GENERAL REQUIREMENTS FOR PIPE MATERIAL

- A. All pipe shall have flexible watertight joints utilizing rubber gaskets, unless otherwise specified.

2.3 HIGH DENSITY POLYETHYLENE (HDPE) PIPE/FITTINGS

- A. All pipe/fitting sizes shown on plans are iron pipe size diameters unless otherwise indicated.
- B. Unless otherwise specified, all HDPE pipe/fittings shall have a standard dimension ratio (SDR) of 17.
- C. HDPE pipe/fittings shall be co-extruded from PE 3608 or PE 4710 virgin resins meeting the specifications as defined in ASTM D3350. Pipe shall be manufactured in accordance with AWWA C906 and ASTM F714.
- D. HDPE pipe/fitting material shall be high-density, extra-high molecular weight polyethylene pipe conforming to ASTM D3350 with a cell classification of 345464C.
- E. Additives may be used provided pipe/fittings still meet the requirements of ASTM D2837.

- F. Pipe/fittings shall contain no recycled compound except that generated within the manufacturer's own plant from resin meeting the same specifications from the same raw material supplier.
- G. Pipe/fittings shall be manufactured in accordance with AWWA C906 and ASTM F714. Lettering shall be legible and permanent under normal conditions of handling and storage. Pipe/fittings shall be clearly and frequently marked with the following information:
 - 1. Name/trademark of pipe manufacturer.
 - 2. Nominal pipe size.
 - 3. Standard Dimension Ratio (SDR).
 - 4. PE 3608 or PE 4710.
 - 5. Manufacturing standard reference.
 - 6. Production code from which date and location of production can be determined.
 - 7. Nominal pressure.
 - 8. Raw material.

2.4 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS (UNDER 4 INCHES)

- A. Pipe and fittings shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784.
- B. PVC pipe and fittings shall be Schedule 80 conforming to ASTM D 1785.

2.5 POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

- A. Conform to ASTM D3034, SDR 35.
- B. Joints shall conform to ASTM D3212 using a restrained rubber gasket conforming to ASTM F477.
- C. Fittings shall be injection molded tees or factory solvent welded saddle tees. Fittings for transition from HDPE to PVC shall include restrained rubber gasket and shall be specifically fabricated for watertight joints for the type of pipes to be joined. Saddles fastened to pipe with external bands are not acceptable on any new system, unless specifically approved by the Engineer.
- D. All PVC sewer pipe shall be considered flexible conduit.
- E. Size of PVC sewer pipe shall not exceed 6 inches.

2.6 TEE AND FITTINGS FOR SEWERS

- A. Unless otherwise specified, all tee connections shall be 6 inches inside diameter and shall be factory made.
- B. All fittings shall be the same material as the pipe, unless otherwise specified. Cast iron fittings may be used for ductile iron pipe.
- C. Fittings shall have sufficient strength to withstand handling and load stresses normally encountered.
- D. All fittings shall be sealed with plugs of same material as the pipe and gasketed with the same gasket material as the pipe joint.

2.7 SIDE SEWER COUPLINGS

- A. Side sewer couplings shall be PVC gasketed adapters or approved equal.
- B. Side sewer couplings at building connections shall be PVC gasketed adapters (IPS x SDR 35), Fernco Strong Back RC Series Repair Couplings or approved equal.

PART 3 - EXECUTION

3.1 SURVEY LINE AND GRADE

- A. The Contractor shall constantly check line and grade of the pipe and in the event they do not meet specified limits, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

3.2 BEDDING

- A. Proper preparation of foundation, placement of foundation material where required, and placement of gravel bedding shall precede the installation of all sewer pipe. This shall include the necessary preparation of the native trench bottom and/or the top of the foundation material as well as placement and compaction of required gravel bedding to a uniform grade. Gravel bedding around the pipe will be placed in a manner to meet requirements specified herein.
- B. Class F bedding shall be provided for all flexible pipe.
- C. The gravel bedding shall be placed so that the entire length of the pipe will have full bearing on the bedding. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug to assure uniform support along the pipe barrel.
- D. It may be necessary to change bedding classifications and the limits thereof during the progress of the construction, consistent with the requirements outlined under the definitions and requirements of the various classifications contained herein.
- E. Where unauthorized excavation has been made below the established grade, the Contractor shall provide, place and compact suitable bedding material to the proper grade elevation at his own expense.
- F. Classification of Bedding:
 - 1. Class A (Special Concrete Bedding) shall consist of a pipe cradle constructed of Portland cement concrete containing not less than four (4) sacks of cement per yard. Maximum aggregate size shall be 1/2 inches. Maximum slump shall be 4 inches. The Contractor shall protect pipe against flotation during the pouring of the concrete. The bottom of the trench shall be fully compacted before placement of pipe or cradle. Cradle construction shall conform to the Standard Detail.
 - 2. Class B (Normal Gravel Bedding) shall consist of the leveling of the bottom of the trench and/or the top of the foundation material at the appropriate elevation, and the furnishing and placing of gravel bedding under the pipe and along the sides of the pipe. Minimum thickness of the layer of gravel bedding required under any portion of the pipe shall be four inches for all pipe sizes of 27 inches diameter and smaller, and six inches for all pipe sizes of 30 inches diameter and larger. Bedding shall extend up to the mid-point of rigid pipe. Gravel bedding shall be carefully placed and firmly compacted to provide a firm, uniform cradle for the pipe.
 - 3. Class C (Shallow Gravel Bedding) shall meet the requirements outlined for Class B bedding except that gravel bedding need be placed only to the lower quadrant of the pipe. This type of

- bedding will be used only where specifically designated on the Plans and only for shallow pipelines.
4. Class D (Native Bedding) shall consist of carefully excavating the trench to proper grade and placing select native material around the pipe. Native bedding, as described, shall be considered as incidental to the construction and all costs thereof are included in the unit contract price of the Contract. Native bedding shall be used only where specifically called for or specifically authorized by the Engineer.
 5. Class F bedding shall be placed in more than one lift. The first lift to provide at least 4-inch thickness under any portion of the pipe shall be placed before the pipe is installed and shall be spread smoothly so that the pipe is uniformly supported along the barrel. Subsequent lifts of not more than 6-inch thickness shall be placed to 6 inches over the crown on the pipe and individually compacted to 95% of maximum density.

3.3 PIPE LAYING

- A. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared.
- B. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.
- C. Pipe laid shall be retained in position by mechanical means or otherwise, as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. Wherever moveable shoring (steel box) is used in the ditch, pipe shall be restrained by use of a winch mounted in the downstream manhole and a line of sufficient strength threaded through the pipe and set tightly before each move. Any indication that joints are not being adequately held shall be sufficient reason to require this or other equivalent method of restraint, whether or not moveable shoring is being used.
- D. Variance from established line and grade shall not be greater than 1/32 of an inch per inch of pipe diameter, not to exceed 1/2 inch provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed 1/64 inch per inch of pipe diameter, 1/2 inch maximum.
- E. The sewer pipe shall be laid upgrade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end forward or upgrade.
- F. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a temporary plug.
- G. As the pipe is installed, it shall be backfilled with the specified gravel bedding material up to an elevation 6 inches above the pipe crown, taking care that the gravel bedding is in contact with the entire periphery of the pipe. The gravel bedding shall be so carefully placed and firmly compacted that the subsequent backfilling operations will not disturb the pipe in any way.
- H. Pipe branches, stubs or other open ends that are not to be connected immediately shall be plugged with approved material consistent with these Specifications and secured in place.

3.4 PIPE JOINTING

- A. All sewer pipe, unless otherwise specified, shall be made with sewer pipe jointed by means of a flexible gasket which shall be fabricated and installed in accordance with these Specifications.

- B. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with soil or other foreign material. Any gaskets so disturbed shall be removed and replaced, cleaned and re-lubricated if required before the jointing is attempted.
- C. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.
- D. Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted.
- E. At the end of the work day, the last pipe laid shall be blocked to prevent creep during "down time."
- F. For dissimilar pipes where suitable adaptor couplings are not available, the jointing shall be accomplished with a special factory fabricated coupling.

3.5 CLEANING

- A. Before acceptance testing is performed, the pipe installation should be reasonably clean. The pipe shall be cleaned before testing the pipe in the following or equivalent manner.
- B. The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction and/or repair any damaged pipe. All visible leaks showing flowing water in pipelines or manholes shall be stopped even if the test results fall within the allowable leakage.

3.6 TESTING GENERAL REQUIREMENTS

- A. All gravity sanitary sewer pipe and appurtenances shall be cleaned and tested after backfill by the low-pressure air test method. All pressure sewer pipe and appurtenances shall be cleaned and tested after backfill by the method described in the Pressure Testing of HDPE Pipelines section below.
- B. All work involved in cleaning and testing sewer lines (less mandrel testing) shall be completed within fifteen (15) working days after the backfilling of sewer lines and structures.
- C. The Contractor shall furnish all labor, materials, tools and equipment necessary to make the test, to clean the lines and to perform all work incidental thereto.
- D. Precautions shall be taken to prevent joints from opening during tests, and any damage resulting from tests shall be repaired by the Contractor at his own expense.
- E. If the pipe installation fails to meet the testing requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall replace all defective materials or workmanship.

The completed pipe installation shall be retested in the method required to meet the requirements of the test.

3.7 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

- A. Refer to Section 33 01 30.13.

3.8 PRESSURE TESTING OF HDPE PIPELINES

- A. Refer to Section 33 01 30.13.

3.9 DEFLECTION TEST FOR FLEXIBLE PIPE

- A. Refer to Section 33 01 30.13.

3.10 VIDEO INSPECTION

- A. The Owner requires all sewers to be inspected by the use of a video camera before final acceptance. The costs incurred in making the inspection shall be borne by the Contractor.
- B. A device will be attached in front of the camera to measure the depth of any ponding water.
- C. Any observed defects or ponded water with a depth of over 3/4 inch shall be cause for the rejection of the line.
- D. The Contractor shall bear all costs incurred in correcting any deficiencies found during television inspection including the cost of any additional television inspection that may be required by the Owner to verify the correction of said deficiency.
- E. The Contractor shall be responsible for all costs incurred in any video inspection performed solely for the benefit of the Contractor.
- F. Video equipment shall consist of a self-contained camera and a monitoring unit connected by three wire coaxial cable.
- G. Camera shall be small enough to ensure passage through a six-inch diameter sewer; 3-inch for side sewer inspections, shall be waterproof, and shall have a self-continuous 650-line resolution picture showing the entire inside periphery of the pipe.
- H. Furnish video recordings of the sewer lines on CD, DVD or flash drive in MP4 or similar file format readable by Windows Media Player, Quicktime, or VLC Video Player software to the Owner and Engineer.
- I. Video inspection shall be performed on one manhole section at a time by propelling the television camera through the line along the axis of the pipe. The inspection shall be performed in a forward (upstream) direction, unless otherwise allowed by the Owner.
- J. Video inspection shall result in a continuous recording, beginning with the camera above grade with a pan view of the immediate vicinity of the originating manhole, then continuing while camera is placed in sewer and advanced to end manhole or segment being inspected.

- K. The video inspection shall be done at a speed (maximum 0.5 feet per second) and quality that allows the Owner to identify all pipe defects and sewer branches.

3.11 REPAIRS

- A. Any pipe or appurtenance which has been laid or jointed that is not in conformance with the Specifications shall be repaired or be removed and replaced at the expense of the Contractor.
- B. Any concrete pipe or manhole with any continuous crack having a surface width of 0.01 inch or more extending for a length of 12 inches or more regardless of position in the wall of the pipe or main shall be removed and replaced.
- C. Repair bands or clamps or concrete collars shall not be used to repair defective pipe.

END OF SECTION 22 13 13

SECTION 22 13 15 – FACILITY SANITARY SEWER MANHOLES AND CLEANOUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

- A. Testing By Manufacturer:
 - 1. Manufacturer shall test all material as required by these Specifications and the Standards referenced.
 - 2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meets or exceeds the specification requirements.
 - 3. No material shall be delivered until test results and certifications are in the possession of the Engineer.
 - 4. The Engineer shall have free access to all testing and records pertaining to materials to be delivered to the job site.
 - 5. The Engineer may elect to be present at any or all material testing operations.

PART 2 - PRODUCTS

2.1 CAST METAL FRAMES AND COVERS

- A. Conform to Manhole Frame and Cover Detail
- B. Frames shall be gray-iron conforming to the requirements of AASHTO M105 (ASTM A48), Grade 30B. Covers shall be ductile iron conforming to ASTM A536, Grade 80-55-06.
- C. Be free of porosity, shrink cavities, cold shuts, or cracks or any surface defects which would impair serviceability.
- D. Repair of defects by welding or by the use of "smooth-on" or similar material will not be permitted.
- E. Manufacturer shall certify that the product conforms to the requirements of these specifications.
- F. Apply a bituminous coating to all surfaces. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adhered to the casting.
- G. The Owner shall have the right to require inspection and approval of all castings prior to painting.
- H. Machine finish the horizontal seating surface and inside vertical recessed face of the frame, and the horizontal seating surface and vertical outside edge of the cover to the following tolerances.
 - 1. Frame +3/32 inch to -3/32 inch. Cover +3/32 inch to -3/32 inch.

2. Cover shall not rock when it is seated in any position in its frame.
 3. There shall be not more than 3/16 of an inch side play in any direction between the cover and the frame when any cover is placed in any position in its frame. All covers shall be interchangeable within the dimensions shown on the details.
-
- I. All frames and covers shall be identified by the name or symbol of the manufacturer in a plainly visible location when the frame and cover is installed. In addition to the manufacturer's identification, when ductile iron is furnished, the material shall be identified by the notation "DUC" or "DI". The manufacturer's identification and the material identification shall be adjacent to each other and shall be minimum 1/2-inch to maximum 1-inch high letters recessed to be flush with the adjacent surfaces.
 - J. Cover shall have type of service indicated on cover with two inch raised letters such as water, sewer or drain.
 - K. Cover shall be the bolt-down type with separate provision for lifting/removal per detail.

2.2 CLEANOUT FRAMES AND COVERS

- A. Conform to Sewer Cleanout Detail.

PART 3 - EXECUTION

3.1 CLEANOUTS

- A. Sewer cleanouts shall be constructed as shown on the standard plan.
- B. All materials incorporated into the cleanout structure shall meet the requirements of the various applicable sections of these specifications.
- C. Pipe joints shall be the type specified for sewer pipe used.
- D. The trench excavation shall be made in such a manner as to provide an undisturbed base upon which the pipe shall be placed.
- E. Bedding around and under the pipe shall be tamped.

END OF SECTION 22 13 15

SECTION 22 13 17 – FACILITY SANITARY SEWER VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

- A. Testing by Manufacturer:
 - 1. Manufacturer shall test all materials as required by these specifications and the standards referenced.
 - 2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specification requirements.
 - 3. No materials shall be delivered until test results and certifications are in the hands of the Engineer.
 - 4. Engineer shall have free access to all testing and records pertaining to materials to be delivered to the job site.
 - 5. The Engineer may elect to be present at any or all materials testing operations.

PART 2 - PRODUCTS

2.1 PVC VALVES

- A. Unless otherwise shown or required, all valves, unions, and strainers in PVC piping shall be constructed of Type 1, Grade 1 PVC. Valves shall be NSF approved and shall have a working pressure of 125 psi.
- B. Ball valves shall have double union type body, Teflon seats, Viton or EPDM seals, full diameter port, and solvent-weld/threaded ends.
- C. Check valves shall be of the ball type with union body, Viton or EPDM seat, and solvent-weld/threaded ends, allowing a fully-ported opening.

2.2 SERVICE CHECK VALVES

- A. Service check valves shall be E/One Uni-Lateral assembly or approved equal.

PART 3 - EXECUTION

3.1 BLOCKING

- A. Provide blocking for valve not connected to fitting with bolted connection.

3.2 TESTING

- A. Test valves along with pipeline in which they are installed.

END OF SECTION 22 13 17

SECTION 221343 - FACILITY PACKAGED SEWAGE PUMPING STATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31 and 32 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes a packaged and tested sewage pumping station with submersible semi positive displacement grinder sewage pumps. The work covered by this section includes furnishing all labor, equipment and materials required to install and test grinder pump units and polyvinyl chloride (PVC) pressure pipe and PVC gravity pipe, including pump, containment basin (optional), electrical connection, electrical control box, pipe, valves, fittings, couplings, adaptors, junction boxes, cleanouts, penetration repairs and accessories, as shown on the Drawings and/or specified herein.
- B. Station consists of a grinder pump core(s) all suitably mounted on an integral stand of stainless steel, special polyethylene tank, electrical quick disconnect (NEMA 6P), pump removal harness, discharge assembly/shut-off valve, anti-siphon valve/check valve assembly, electrical alarm assembly and all necessary internal wiring and controls.
- C. The Contractor shall furnish and install all electrical connections as specified by the manufacturer.
- D. All piping and accessories are not necessarily shown complete on the Drawings. The Contractor shall furnish and install all piping indicated or required for proper operation of the equipment.
- E. Furnish each piece of equipment complete with its base, drives, shafting, couplings, controls, guards, and other appurtenances which are specified or are required for proper and safe operation.
- F. All railings, stairs, guards, platforms, etc., shall meet or exceed federal OSHA and state requirements.
- G. Fabricate, assemble, erect, place, and test all specified materials and equipment in full conformity with all contract documents and manufacturer's recommendation.
- H. Provide spare parts as required in Division 01.

1.3 PERFORMANCE REQUIREMENTS

- A. Pressure Rating of Sewage Pumps and Discharge Piping Components: At least equal to sewage pump discharge pressure, but not less than 100 psig.
- B. Pressure Rating of Other Piping Components: At least twice the system operating pressure.

- C. The pumps shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for each packaged sewage pumping station. Detail equipment assemblies and indicate dimensions; shipping, installed, and operating weights; loads; required clearances; method of field assembly; components; electrical characteristics; and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of sewage pump, signed by product manufacturer.
- B. Typical pump curves.
- C. Warranty: Special warranty specified in this Section and executed by the grinder pump Manufacturer, which certifies a minimum of a 24-month warranty. The warranty must further detail any exclusions from the warranty or additional cost items required to maintain the equipment in warrantable condition, including all associated labor and shipping fees, and certify that the Contractor or Manufacturer shall bear all costs to correct any original equipment deficiency for the effective period of the warranty. All preventive maintenance type requirements shall be included in this form as exclusions. These requirements include, but are not limited to, unjamming of grinder mechanism, periodic motor maintenance, and periodic cleaning of liquid level controls.
- D. The Contractor shall submit to the manufacturer all required data, information, or materials in the fashion necessary to obtain the extended warranty and convey to the Owner. In one embodiment, after installation and start-up data, have been successfully completed the Contractor, shall submit the required information via apps.eone.com to be issued a 5-Year Certified Installation Program certificate for each applicable WH482 grinder pump station. This certificate is the proof of the program coverage. This certificate shall be conveyed to the Owner.
- E. Drawings and Data: In conformance with procedures set forth in Division 01, submit complete assembly, foundation, and installation drawings, together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of the equipment, as well as complete performance data.
 - 1. Include weights and principal dimensions.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For equipment to include in emergency, operation, and maintenance manuals.

- B. Operations and Maintenance Manuals:
 - 1. Supply operation and maintenance manuals prepared by equipment suppliers.
 - a. Equipment function, normal operating characteristics, and limiting conditions.
 - b. Assembly, installation, alignment, adjustment, and checking instructions.
 - c. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 - d. Lubrication and maintenance instructions.
 - e. Guide to "troubleshooting".
 - f. Parts lists and predicted life or parts subject to wear.
 - g. Outline, cross sections, and assembly drawings; engineering data; and wiring diagrams.
 - 2. Furnish operations and maintenance manuals in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1.7 QUALITY ASSURANCE

- A. Manufacturer shall furnish all services required in this Section.
- B. All pumping equipment, pipe, valves, penetrations and fittings furnished under this section shall be new, unused, and the manufacturer's current production model. Unit must conform to the best practice known to the trade in design, quality of material, and workmanship. Assemblies, subassemblies, and component parts shall be standard and completely interchangeable. The equipment must conform with all applicable federal state, and local regulations.
- C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with UL 778, "Motor-Operated Water Pumps," for sewage pumps.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 32 13 13 "Concrete Paving".

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged sewage pumping stations that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including shell.
 - b. Faulty operation of sewage pumps, controls, or accessories.

- c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - d. Faulty or inadequate design
 - e. Improper assembly or erection
 - f. Leakage, breakage, or other failure
- 2. Warranty Period for Shells: 2 years from date of final acceptance.
- 3. Warranty Period for Sewage Pumps and Controls: 2 years from date of final acceptance.
- 4. Warranty Period for Accessories: 2 years from date of final acceptance.
- B. Any manufacturing defects found during the warranty period will be reported to the Contractor by the Owner and will be corrected by the Contractor at no cost to the Owner.

1.10 PATENT ROYALTIES

- A. Equipment suppliers quoted prices include all royalties and fees for patents covering materials, articles, apparatus, devices, or equipment.

1.11 PROTECTION

- A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling and storage.
- B. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.
- C. Store pumps, motors, and electrical equipment in weather tight warehouses at maintained temperature of 60°F minimum.
- D. Painted Surfaces:
 - 1. Protect against impact, abrasion, discoloration and other damage.
 - 2. Repaint to satisfaction of Engineer all painted surfaced which are damaged prior to acceptance of equipment.
- E. Protect electrical equipment, controls and insulation against moisture and water damage.

1.12 ADAPTION OF EQUIPMENT

- A. Furnish equipment readily adaptable for installation and operation in the structure shown on the Drawings. Equipment furnished shall be compatible with all other equipment furnished.
- B. Assume full responsibility for alteration of the planned structure to accommodate other types of equipment. Assume full responsibility for all modifications of mechanical and electrical controls, equipment, wiring, piping, as required to accomplish the functions specified.
- C. Equipment which required alteration of the structure, piping, and/or electrical work will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations.

PART 2 - PRODUCTS

2.1 WET-WELL, PACKAGED SEWAGE PUMPING STATIONS

A. Environment One WH482:

1. Pump:

- a. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the **progressing cavity type** with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2. Grinder:

- a. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.
- b. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
 - 1) The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 - 2) The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.

- 3) The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.
- 4) The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
- c. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.
3. Electric Motor:
 - a. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F insulation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. The motor protector shall be specifically investigated and listed by Underwriters Laboratories Inc. for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. The wet portion of the motor armature must be 300 Series stainless steel. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted. Pump operation during instances of potentially damaging high current or low voltage conditions shall be inhibited by an in-pump electrical monitoring system that has been investigated and listed by Underwriters Laboratories Inc. for the application. Motor start shall be controlled by a DC driven electromechanical relay integrated within the control compartment of the pump. Electrical monitoring shall ensure the relay operates reliably. AC Mechanical contactors for motor start are susceptible to damage from short cycling and will not be accepted.
4. Mechanical Seal:
 - a. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.
5. Tank – Polyethylene Construction:
 - a. The tank shall be made of rotational molded polyethylene with high environmental stress cracking resistance. All seams created during tank construction are to be factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

- b. The overall basin capacity shall be 486 gallons. The basin shall incorporate a tapered bottom with an inside diameter of no greater than 46 inches, reducing to a diameter of no greater than 42 inches to minimize the retained volume. The largest diameter must be no less than 50 inches and no greater than 52 inches.
 - c. A station that is 75 inches tall shall have no greater than a 50 inch outside diameter hinged aluminum cover. The 75 inch tall station can be extended in 6 inch increments with normal cylindrical fiberglass extensions.
 - d. Taller stations shall have a fiberglass accessway with a hinged, aluminum cover. The accessway shall be an extension of the wetwell assembly and shall include a lockable cover assembly, with vent, providing low profile mounting. The cover shall be aluminum, with a load rating of 300 pounds per square foot. The cover shall have an outside diameter of no greater than 50 inches. Accessway design and construction shall enable field extension of station height in 6-inch increments without the use of any adhesives or sealants requiring cure time before installation can be completed. The accessway wall must withstand the pressure exerted by saturated soil loading at maximum burial depth and must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure. The tank and factory penetrations shall be factory tested and guaranteed to be watertight.
 - e. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe. Tank dimensions shall be as shown on the contract drawings.
 - f. The discharge bulkheads (manifolds) shall be factory installed and warranted by the manufacturer to be watertight. The following provides a description and orientation of the discharge bulkhead(s) for each station type:
 - 1) Duplex Station: The tank shall have one stainless steel duplex discharge manifold terminating outside the tank wall with a 1-1/4" female NPT pipe thread.
6. Discharge Hose and Disconnect/Valve:
- a. All discharge fittings and piping shall be constructed of polypropylene, EPDM or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
7. Electrical Quick Disconnect:
- a. The grinder pump core shall include a factory-installed NEMA 6P electrical quick disconnect (EQD) for all power and control functions. The EQD will be supplied with 32' total, 25' of useable, electrical supply cable (ESC) to connect to the alarm panel. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. Junction boxes are not acceptable due to the large number of potential leak points. The EQD shall be so designed to be conducive to field wiring as required.
8. Check Valve:
- a. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss

of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The valve shall be rated for continuous operating pressure of 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

9. Anti-Siphon Valve:

- a. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

10. Core Unit:

- a. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 PSIG.

11. Controls:

- a. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating motor starting controls in a plastic enclosure is not acceptable. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermoplastic elastomer. The use of PVC for the level sensing housing is not acceptable.
- b. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
- c. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column

sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

12. Stainless Steel Curb Stop/Check Valve Assembly:
 - a. The curb stop shall be pressure-tight in both directions. The ball valve actuator shall include position stop features at the fully opened and closed positions. The curb stop/check valve assembly shall be designed to withstand a working pressure of 235 psi.
 - b. The stainless steel check valve shall be integral with the curb stop valve. The check valve will provide a full-ported 1-1/4" passageway and shall introduce minimal friction loss at maximum rated flow. The flapper hinge design shall provide a maximum degree of freedom and ensure seating at low back pressure.
13. Engineered Thermoplastic Fittings:
 - a. All plastic fitting components are to be in compliance with applicable ASTM standards.
 - b. All pipe connections shall be made using compression fitting connections including a Buna-N O-ring for sealing to the outside diameter of the pipe. A split-collet locking device shall be integrated into all pipe connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.
14. Curb Boxes
 - a. Curb boxes shall be constructed of ABS, conforming to ASTM-D 1788. Lid top casting shall be cast iron, conforming to ASTM A-48 Class 25, providing magnetic detectability, and be painted black. All components shall be inherently corrosion-resistant to ensure durability in the ground. Curb boxes shall provide height adjustment downward (shorter) from their nominal height.
15. High Density Polyethylene Pipe (Supplied by others)
 - a. Pipe shall have a working pressure of 160 psi minimum and shall be classified SDR per ASTM D 3035.
16. Pipe Dimensions
 - a. The SDR (Standard Dimension Ratio) of the pipe supplied shall be as specified by the SPECIFYING ENGINEER. SDR 7, 9 and 11 fittings are available from the manufacturer.
17. Factory Test

- a. The stainless steel, combination curb stop/check valve component shall be 100 percent hydrostatically tested to 150 psi in the factory.
18. Construction Practices
- a. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be in accordance with the pipe manufacturer's recommendations. The pipe should be handled in such a manner that it is not damaged by being dragged over sharp objects or cut by chokers or lifting equipment.
 - b. Segments of pipe having cuts or gouges in excess of 10 percent of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method. Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt-fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt-fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.
 - c. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable-type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long, fused sections. Care should be exercised to avoid cutting or gouging the pipe.
19. Installation
- a. Assemble the compression fittings according to the fitting manufacturer's recommendations.
 - b. The trench and trench bottom should be constructed in accordance with ASTM D 2321. Embedment materials should be Class I, Class II or Class III materials as defined in ASTM D 2321. The use of Class IV and/or Class V materials for embedment is not recommended and should be allowed only with the approval of the SPECIFYING ENGINEER. Bedding of the pipe should be performed in accordance with ASTM D 2321. Compaction should be as specified in ASTM D 2321. Deviations from the specified compaction shall be approved by the SPECIFYING ENGINEER.
 - c. Haunching and initial backfill should be as specified in ASTM D 2321 using Class I, Class II or Class III materials. Materials used and compaction shall be as specified by the SPECIFYING ENGINEER. In cases where a compaction of 85 percent Standard Proctor Density is not attainable, the SPECIFYING ENGINEER may wish to increase the SDR of the pipe to provide adequate stiffness. ASTM D 2321 sections titled "Minimum Cover for Load Application," "Use of Compaction Equipment" and "Removal of Trench Protection" should apply unless directed otherwise by the SPECIFYING ENGINEER.

B. Alarm Panels:

1. Duplex Protect Plus:

- a. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and

- creating a secured safety front to allow access only to authorized personnel. The standard enclosure shall not exceed 12.5" W x 16" H x 7.5" D.
- b. The panel shall contain one 15-amp single pole circuit breaker for the alarm circuit and one 15-amp double pole circuit breaker per core for the power circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.
 - c. The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).
 - d. The high-level alarm system shall operate as follows:
 - 1) The panel will go into alarm mode if either pump's alarm switch closes. During the initial alarm mode both pumps will run and the alarm light and buzzer will be delayed for a period of time based on user settings (default is 3-1/2 minutes). If the station is still in high-level alarm after the delay, the light and buzzer will be activated.
 - 2) The audible alarm may be silenced by means of the externally mounted push-to-silence button.
 - 3) The visual alarm remains illuminated until the sewage level in the wet well drops below the "off" setting of the alarm switch for both pumps.
 - e. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.
 - f. Contains the following features:
 - 1) Alarm Activated Dry Contacts – Normally open relay contact closes upon alarm activation.
 - 2) Alarm Activated Contacts for Remote Indoor Alarm Module – Will work with or without power to the alarm panel and is designed to work with E/One's Remote Sentry.
 - 3) Includes Inner Door Dead Front
 - 4) Separate LED's for each condition
 - g. Provides protection from the following operating conditions:
 - 1) Low Voltage (Brownout) Protection – A lockout cycle will prevent the motor from operating and will illuminate the Trouble LED if:
 - a) the incoming AC Mains voltage drops below a predetermined minimum, typically 12% of nameplate (211 volts for a 240 volt system) for 2 to 3 seconds, regardless of whether the motor is running
 - b) the lockout cycle will end if the incoming AC Mains voltage returns to a predetermined value, typically 10% of nameplate (216 volts for a 240 volt system).
 - 2) The system continues to retest the voltage every second indefinitely. If the lockout cycle has been initiated and the voltage comes back above the predetermined starting voltage, the system will function normally. The Trouble LED remains illuminated during a Brownout condition and a corresponding Brownout message will be displayed on the LCD screen. The LED will turn off when the Brownout condition ends and the LCD message remains latched until the panel is reset. The audible and visual alarm will not be activated unless there is a high wastewater level in the tank.

- 3) Run Dry Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate the Trouble LED when the wastewater level in the tank is below the pump inlet shroud. A corresponding Run Dry message will be displayed on the LCD screen. The condition is rechecked every 20 minutes and the LCD message remains latched. If the condition is satisfied, the pump is allowed to cycle normally and the Trouble LED will go out, but the LCD message remains latched. The LCD message will remain latched until the panel is reset. If the condition is not satisfied after 3 consecutive attempts, the visual alarm will be activated until the panel is reset or until there is one cycle of normal operation. If a high level condition is presented at any time, a pump run cycle will be activated.
 - 4) High System Pressure Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate the Trouble LED when the pressure in the discharge line is atypically high (closed valve or abnormal line plug). A corresponding Overpressure message will be displayed on the LCD screen. The condition is rechecked every 20 minutes. If the condition is satisfied, the pump is allowed to cycle normally and the Trouble LED will turn off, but the LCD message remains latched. The LCD message will remain latched until the panel is reset. If the condition is not satisfied after 3 consecutive attempts, the pump is locked out indefinitely and the audible and visual alarm will be activated. The LCD message and alarms will remain latched until the condition is removed and the panel is reset.
- h. In all of the above cases, if more than one error condition is presented, the LCD message depicting the most recent error condition will be displayed.
2. Protect Plus Features:
 - a. High/Low Voltage monitoring with Trouble indication
 - b. High/Low Wattage (wattage is used instead of current because it is a better indicator of pump performance) monitoring with Trouble indication
 - c. Extended Run Time monitoring with Trouble indication
 - d. Cycle/Event Counter
 - e. Run Time Counter (Hour Meter)
 - f. Run Time Limit — time adjustable, user-selected options: 10 minutes (default) to 120 minutes in 1-minute intervals
 - g. Power-up Delay — time adjustable, user-selected options: None (default), to 300 minutes in 1-minute intervals
 - h. Alarm Delay — time adjustable, user-selected options: zero to 10 minutes in 30-second increments; 4 minutes is default
 - i. System self-test diagnostic
 - j. User-selectable Alarm latch
 - k. User-selectable Protect Mode disable
 - l. User-selectable buzzer timer
 3. Specific Duplex Protect PLUS indicators and programming features shall include:
 - a. Ready LED to indicate AC power to the station is satisfactory
 - b. Pump Run LED to indicate pump is operating (LCD indicates which pump is running)
 - c. Trouble LED indicator and predictive Visual Alarm notification (“blinking” alarm lamp; clears on Normal cycle)
 - d. High Level Alarm LED indicator (LCD indicates which pump is in alarm)

- e. Manual Run switch to manually activate pumps
 - f. Lead/Lag indication (LCD indicates which pump is lead)
 - g. Menu-driven programmable controller with navigation overlay-type buttons (Enter, Scroll, Up, Down)
 - h. Normal Operation LED and Mode button for Mode status
 - i. Pump Performance menu LED with LCD display of the following pump performance statistics:
 - 1) Real-time Voltage
 - 2) Real-time Amperage
 - 3) Real-time Wattage
 - 4) Minimum/Maximum/Average Voltage
 - 5) Minimum/Maximum/Average Amperage
 - 6) Minimum/Maximum/Average Wattage
 - 7) Minimum/Maximum Run-time
 - 8) Average Run-time
 - 9) Last Run-time
 - 10) Cycle/Event Counter
 - 11) Run Time Counter (Hour Meter)
 - j. Diagnostics Menu LED
 - k. Initialize System Menu LED
 - l. Run Limit Menu LED
 - m. Alarm Delay Menu LED
 - n. Power Delay Menu LED
 - o. Pump alternating options (no alternation, adjustable time based and test)
 - p. Pump alternating time options — 24 hours to 72 hours in 12-hour increments
4. Generator Receptacle and Auto Transfer
- a. The alarm panel shall include a 20 amp, 250 VAC generator receptacle with a spring-loaded, gasketed cover suitably mounted to provide access for connection of an external generator while maintaining a NEMA 4X rating. An automatic transfer switch shall be provided, which automatically switches from AC power to generator power. Power shall be provided to the alarm panel through the generator receptacle whenever power is present at the receptacle, allowing the audible and visual alarms to function normally in generator mode. When power is no longer applied to the generator receptacle, the panel is automatically switched back to the AC Mains power. (No manual switching within the panel enclosure is necessary to switch from generator power back to AC Mains, so the mode cannot be inadvertently left in the generator position after pumping down the station in generator mode as is the case with a manual transfer switch).
5. Service Equipment/Main Service Disconnect Breaker
- a. A separate, internal breaker that is rated and approved for use as “service equipment” and acts as a main service disconnect of the grinder pump station shall be provided.
6. Remote Sentry Indoor Alarm Module
- a. A separate, remote indoor alarm module shall be provided to indicate a high level alarm with or without AC power to the grinder pump station. The Remote Sentry indoor alarm module shall have an internal power source enabling its continued operation without AC power. The Remote Sentry shall have an audible alarm and a visual alarm, both of which shall automatically reset if the high level alarm condition

is eliminated. The Remote Sentry indoor alarm module shall include a Silence button for the audible alarm and a Test button.

7. External Autodialer
 - a. Four separate voice message alarm zones
 - b. Calls up to 8 telephones, cell phones or pagers
 - c. Built-in line seizure
 - d. Remote Turn Off feature allows termination of activated channel
 - e. EEPROM Memory retains program despite power loss
 - f. Listen-in verification and communication
 - g. Universal dial tone
 - h. Built-in auxiliary output to drive external siren, strobe or relay
 - i. Five optional settings for notifications of a power loss occurrence — instantaneous, 15 minutes, 2 hours, 12 hours or 24 hours
 - j. One channel for power-loss sensing, three hardwired channels for additional input
 - k. Dialer senses loss of power and based on setting; will notify parties of loss condition only when specified time has elapsed
 - l. If power restores before set time has elapsed, no call will be made
 - m. Package includes battery backup and transformer

2.2 SERVICABILITY

- A. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.3 OSHA CONFINED SPACE

- A. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). “Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant’s body breaks the plane of an opening into the space.”

2.4 SAFETY

- A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc., to be safe and

appropriate for the intended use. UL listing of components of the station, or third-party testing to UL standard are not acceptable.

- B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard is not acceptable.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect pumps prior to shipment. Include test recordings that substantiate correct performance of pumps at design head, capacity, suction lift, speed, and horsepower.
- B. Test accessories and controls through complete cycle. Include test recordings that substantiate correct performance.

PART 3 - EXECUTION

3.1 DELIVERY

- A. All grinder pump core units, including level controls, will be delivered to the job site 100 percent completely assembled, including testing, ready for installation. Grinder pump cores will be shipped separately from the tanks. Installing the cores and discharge piping/hose into the tanks is the only assembly step required and allowed due to the workmanship issues associated with other on-site assembly. Grinder pump cores must be boxed for ease of handling.

3.2 EXAMINATION

- A. Examine unit for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of sewerage piping systems to verify actual locations of piping connections before packaged sewage pumping station installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.4 INSTALLATION

- A. Install packaged sewage pumping station components where indicated, according to specific equipment and piping arrangement indicated.

- B. The Contractor shall be responsible for managing ground water to provide a firm, dry subgrade for the structure, and shall protect against flotation or other damage resulting from general water or flooding.
- C. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the Engineer. The diameter of the excavated hole shall be large enough to allow for the concrete anchor.
- D. User instructions shall be given to the Owner.
- E. Hardware supplied with the unit shall be used at installation.
- F. The basin may not be dropped, rolled or laid on its side for any reason.
- G. A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.
- H. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the manufacturer's instructions, shall be installed and shall be pre-cast to the grinder pump or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.
- I. Installation shall be accomplished so that 1 inch to 4 inches of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit.
- J. Backfill unit in accordance with geotechnical information provided with this Manual, or as recommended by the manufacturer.
- K. E/One Uni-Lateral assembly shall be installed between the pump discharge and the street main on all installations.
- L. The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the Contractor. It shall be the responsibility of the Contractor and the Engineer to coordinate with the Owner to determine the optimum location for the alarm panel.
- M. The installation shall include an alarm device. The Contractor shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable.
- N. The grinder pump stations shall be provided with the necessary quantity of useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a FACTORY INSTALLED EQD half to connect to the mating EQD half on the core.

3.5 CONNECTIONS

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified. If Drawings are explicit enough, these requirements may be reduced or omitted.
- B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard is not acceptable.
- C. Ground equipment according to NEC.
- D. Connect wiring according to NEC.

3.6 IDENTIFICATION

- A. Install identifying labels permanently attached to equipment.
- B. Install operating instruction signs permanently attached to equipment or on pumping station wall near equipment.

3.7 FACTORY TEST

- A. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps is not acceptable. Certified test results shall be available upon request showing the operation of each grinder pump at two different points on its curve. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.
- B. The Engineer reserves the right to inspect such testing procedures with representatives of the Owner, at the Manufacturer facility.
- C. All HDPE basins shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (gaskets etc.)

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:

1. After installing packaged sewage pumping stations and after electrical circuitry has been energized, test for compliance with requirements.
 2. Upon completion of the installation, the authorized factory technician(s) will perform the following test on each station:
 - a. Make certain the discharge shut-off valve in the station is fully open.
 - b. Turn ON the alarm power circuit and verify the alarm is functioning properly.
 - c. Turn ON the pump power circuit. Initiate the pump operation to verify automatic “on/off” controls are operative. The pump should immediately turn ON.
 - d. Consult the Manufacturer’s Service Manual for detailed start-up procedures.
- C. Upon completion of the start-up and testing, the MANUFACTURER shall submit to the ENGINEER the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

END OF SECTION 22 13 43

SECTION 22 13 45 – FACILITY SANITARY SEWER FORCE MAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

- A. Final Acceptance:
 - 1. Refer to Section 221313.

1.3 SUBMITTALS

- A. The Contractor shall submit the following to the Owner within ten calendar days of the award date of the contract, or as otherwise noted:
 - 1. Manufacturer certification that all furnished material is manufactured, sampled, tested and inspected in accordance with these specifications. An authorized agent of the manufacturer shall sign the certification.
 - 2. Manufacturer's literature for all pipe, fittings, couplings, adapters, and other materials to be furnished for the project.
 - 3. Fusion machine operators shall have attended and successfully completed a training course sponsored by the pipe manufacturer. A written copy of such training certification shall be provided to the Engineer with the installation plan and schedule.
 - 4. All HDPE pipe shall be thermally butt-fused per manufacturer recommendations and ASTM D2657. The pipe manufacturer shall submit a certificate of compliance, stating that the proposed fusing equipment is in compliance with their requirements.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- A. Refer to Section 22 13 13.

2.2 COUPLINGS/ADAPTERS

- A. Refer to Section 22 13 13.

2.3 DETECTABLE LOCATOR TAPE

- A. The tape shall consist of a minimum 4.0 mil thickness, inert polyethylene plastic which is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil, with a minimum 1/3-mil metallic foil. The tape shall be at least three inches (3") in width and shall be solid blue with identifying print in black letters. The tape shall have printed thereon the following or similar as commercially available:

"CAUTION - BURIED SEWER LINE BELOW"
- B. The identifying lettering shall be minimum 1" high and repeated continuously the full length of the tap. In no instance shall the spacing of the individual segment of the identifying message be greater than eighteen inches (18").
- C. Detectable locator tape shall be installed 18 inches above the pipe it identifies. The backfill shall be sufficiently leveled so that the tape will be installed on a flat surface. The tape shall be centered in the trench and laid flat with printed side up. Caution shall be exercised to avoid displacement of tape and to ensure its integrity. The remainder of the trench is then backfilled in accordance with applicable specifications.

PART 3 - EXECUTION

3.1 FUSION JOINING HDPE

- A. All HDPE pipe shall be joined by thermal butt-fusion or sidewall fusion per manufacturer's recommendations and ASTM D2657. The pipe manufacturer shall submit a certificate of compliance stating that the proposed fusing equipment is in compliance with their requirements.
- B. Contractor shall identify means of joining one pipe to another and details for installation prior to beginning work. Joining and installation details shall be subject to the Owner's approval. Threaded or solvent-cement joints and connections are not permitted.
- C. For each polyethylene material there exists an optimum range of fusion conditions, such as fusion temperature, interface pressure, and cooling time. Prior to starting fusion of polyethylene pipe, personnel shall verify that they have this information for the material being joined. Pipe shall be handled, joined, and installed in accordance with the manufacturer's recommendations, AWWA C906, and the manufacturer's representative's directives.
- D. Joints shall have weld strength equal to or greater than the tensile strength of the pipe/fittings. All joints shall have sufficient strength to withstand handling and load stresses normally encountered during and following installation of the pipe.
- E. HDPE pipe/fittings shall be joined into continuous lengths above grade on site whenever possible. Pipe shall be joined on site in appropriate working lengths near the insertion pit. HDPE pipe shall be assembled and stored where accesses to homes, businesses, mailboxes, etc. are not disrupted.
- F. Contractor shall pre-assemble as much pipe as possible before beginning insertion process. If additional pipe is needed, pipe shall be joined as it is being inserted. HDPE pipe shall be joined into the maximum available lengths prior to installing the pipe.

- G. Pipe lengths shall be stored in a manner and location as to protect the pipe from scouring, gouging, or other damage. Internal scouring and external cuts or abrasion deeper than 10% of the wall thickness or pipe sections found to be out of round shall not be used as replacement pipe.
- H. The joints shall be leak proof, thermal, butt-fused joints. All fusing shall be done using tools recommended by the pipe supplier and approved by the Owner. Operators shall be certified by the pipe manufacturer. The fusing machine shall have hydraulic pressure control for fusing two pipe ends together. The ends of pipe shall be trimmed to form perpendicular faces prior to fusing. The heating plate on the fusing machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature. The heating plate shall be subject to periodic inspection, using a temperature stick, to assure even heating.
- I. Joints between pipe sections shall be smooth on the inside. Internal projection beads shall be removed from each pipe joint prior to installation of the pipe. Joints between pipe sections shall not exhibit internal beads that protrude into the pipe more than 1/4-inch. The bead remnants shall be removed from the pipe prior to installation and disposed of. The notch between the beads shall not protrude past the outside limits of the wall of the pipe.
- J. Two joints, selected at random by the Owner from the first total of 1,000 feet shall be tested in compliance with ASTM D638 to ensure that the tensile strength of yield of the butt fusion joints equals or exceeds that of the pipe. The test specimen shall be obtained by cutting the liner pipe at least twelve inches on each side of the field made joint. One additional test shall be made for each additional 1,000 feet of line or portion thereof.
- K. The butt-fused joint shall provide true alignment between the joined pipes and shall have uniform roll back beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe. All joints shall be inspected prior to insertion and shall be subject to acceptance by the Owner. All defective joints shall be cut out and replaced at no cost to the Owner.

3.2 INSTALLATION

- A. Refer to Section 22 13 13.
- B. Install pipe in accordance with specification section for pipeline being installed.
- C. Minimum depth of cover shall be 42 inches unless otherwise shown on the Drawings.
- D. Pipe shall be laid on a uniform grade with no sags or overbends between high and low points shown on the Drawings.
- E. Install detectable locator tape in accordance with manufacturer's recommendations.

3.3 BLOCKING AND BRACING

- A. Blocking and bracing of the pipe and fittings shall be placed so as to secure bearing on undisturbed earth.
- B. Blocking and bracing size shall be determined by the Contractor and shall be of sufficient proportions and installed so as to withstand the required test pressure and operating conditions.

- C. Concrete shall be placed in back of all fittings with unbalanced thrust. Pre cast blocking shall not be used.
- D. Blocking shall not be covered up without its having been seen by the Engineer.
- E. Blocking shall be formed so that bolts, joints, gaskets, and flanges of adjacent joints are clear of the concrete and so that bolts and joints can be dismantled without removing the concrete.
- F. Unless otherwise called for on the Bid Form, the cost of furnishing and installing all blocking shall be included in the price bid per lineal foot of pipe or lump sum bid if unit prices are not required.

3.4 PRESSURE TESTING OF HDPE PIPELINES

- A. Filled pipelines shall be allowed to thermally stabilize such that the temperature of the water and the pipe are equal. At temperatures above one hundred (100) degrees F, the Engineer shall be consulted regarding the need to reduce the test pressure.
- B. The piping shall be tested between valved sections or to a maximum length of one thousand, five hundred (1,500) feet.
- C. For any test pressure from 1.0 to 1.5 times the system design pressure, the total test time including initial pressurization, initial expansion, and time at test pressure, shall not exceed eight hours. If the pressure test is not completed due to leakage, equipment failure or other reason, the test section shall be depressurized, and allowed to “relax” for at least eight hours before bringing the test section up to test pressure again.
- D. Expansion Phase
 - 1. Initial expansion phase: Fill pipe at a controlled flow rate according to the Equation $Q_{\text{gpm}} = 0.402 * D_{\text{inches}}^2$ which is summarized with Table A below for reference. Use of a urethane foam pig, pushed by the fill water, is permissible to aid in air removal in the initial phase.

TABLE A

Pipe Diameter (in)	Initial Phase Fill Rate (gpm)
1	0.4
2	1.5
4	6
6	14
8	25
10	40

- 2. Fill pipe to pressurize test section to 10 psi above the test pressure (see Table B for Expansion Pressure). Add sufficient make-up water each hour to return the pipe pressure to the expansion phase pressure. Pressure should be measured at the lowest elevation in the piping run being tested.
- 3. The initial expansion phase shall be completed after four hours after pressurization.

- E. Test Phase: Reduce pressure by 10 psi and conduct the test for one hour. Make-up water is not allowed during the test phase. Table B below may be used for reference.
1. The test passes after the pressure remains steady within five percent of test phase pressure after one hour.
 2. If the pressure falls below five percent of the test pressure (see Table B), leakage or insufficient expansion is indicated, and the test shall be repeated after the pipe is allowed to “relax” as indicated above and repairs are completed.

TABLE B

Pipe Class (SDR)	Expansion Pressure (psi)	Test Pressure (psi)	5% Reduction Pressure (psi)
17	150	140	133
13.5	170	160	152
11	170	160	152
9	210	200	190

- F. Release water from the test run in a controlled manner to slowly reduce pressure.

3.5 REPAIR

- A. The Contractor shall repair all leaks in the piping at no cost to the Owner.

3.6 PRECAST CONCRETE VAULT INSTALLATION

- A. The bottom of the excavation for the vaults shall be fine graded to a plane surface on firm undisturbed subgrade material.
- B. Granular pipe bedding material shall be uniformly spread to a depth of 4 inches over the bottom of the excavated area to provide uniform bearing for the vault.
- C. Install vault and accessories in conformance with drawings, specifications and recommendations of vault manufacturer unless otherwise instructed in writing by the Engineer.
- D. The vault joints, pipeline, and conduit penetrations through walls as shown on the plans shall be sealed watertight. No leakage will be allowed into the vault.
- E. The manhole ring and cover or access doors shall be adjusted to match the finished surface grade.

END OF SECTION 22 13 45

**SECTION 223000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial gas-fired water heaters.
- B. Sump pumps.

1.02 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.
- B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2023.

1.03 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittals procedures.
- B. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Certifications:
 - 1. Water Heaters: NSF approved.
 - 2. Gas Water Heaters: AHRI Directory of Certified Product Performance.
 - 3. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
 - 4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

- A. See Section 017800 Warranties for additional warranty requirements.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co- See Construction Documents for Schedule.

2.02 SUMP PUMPS

- A. Manufacturers:
- B. Type: Vertical centrifugal, direct connected, simplex arrangement. See Plumbing Construction documents for schedule.
- C. Casing: Cast iron volute with radial clearance around impeller, inlet strainer, slide away couplings.
- D. Impeller: Cast iron; open non-clog, keyed to corrosion resistant alloy steel shaft.
- E. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

- F. Bearings: Forced grease lubricated bronze sleeve spaced maximum 48 inches (1200 mm) and grease lubricated ball thrust at floor plate.
- G. Drive: Flexible coupling to vertical, solid shaft ball bearing electric motor.
- H. Sump: Steel cover plate with steel curb frame for grouting into concrete sump with inspection opening and cover, and alarm fittings.
- I. Controls, Simplex: Float switch with float rod, stops, and corrosion-resistant float, and separate pressure switch high level alarm with transformer, alarm bell and stand-pipe. See Construction Documents for additional requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Domestic Water Storage Tanks:
 - 1. Provide steel pipe support, independent of building structural framing members.
 - 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.
- D. Pumps:
 - 1. Ensure shaft length allows sump pumps to be located minimum 24 inches (600 mm) below lowest invert into sump pit and minimum 6 inches (150 mm) clearance from bottom of sump pit.
 - 2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
 - 3. Align and verify alignment of base mounted pumps prior to start-up

END OF SECTION 223000

SECTION 224000 PLUMBING FIXTURES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 221006 - Plumbing Piping Specialties.
- C. Section 223000 - Plumbing Equipment.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- C. NSF 372 - Drinking Water System Components - Lead Content 2022.
- D. UL (DIR) - Online Certifications Directory Current Edition.

1.03 SUBMITTALS

- A. See Section 220100 General Plumbing Conditions for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.05 WARRANTY

- A. See Section 017800 Warranties for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Maximum Fixture or Faucet Supply Pressure: 60 psi (4.1 bar) unless stated otherwise.
- C. See the plumbing construction documents for specific plumbing fixture makes and models.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 224000

**SECTION 230100
GENERAL MECHANICAL CONDITIONS**

PART 1 GENERAL

1.01 SUMMARY

- A. This section covers the general requirements for all of Division 23- HVAC scope of work.
- B. See Division 01 for additional administrative requirements whether specifically callout out or not in this Division. Reference other Divisions as needed for additional requirements.
- C. Fully coordinate the work of this division with that of other divisions, the contract documents, and other trades.
- D. See section 230800 and Construction Plans for Commissioning Requirements.

1.02 RELATED DOCUMENTS

- A. The requirements of the architectural sections apply to all work of this and all other sections. Anything called for on either the drawings or in the specifications shall form a part of the contract documents as if called out in both.
- B. If any conflict occurs between the rules of governing agencies and this Specification, the more restrictive is to govern (as interpreted by Rensch Engineering). Nothing in these drawings and specifications shall be construed to permit work not conforming with the governing codes and AHJ. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the before mentioned governing agencies and not contrary to same.

1.03 DESCRIPTION OF WORK

- A. The work included in this section shall constitute all Mechanical work (as applicable), connections to utilities, and any incidental items not shown but necessary for complete and operational systems. Fully coordinate the work of this division with that of all other sections.

1.04 HVAC CONTROLS

- A. Controls for HVAC systems:
 - 1. A Building Management System (BMS) or Direct Digital Control (DDC) HVAC control system is required for this facility in accordance with WSEC 2018 Section C403.4.11. This framework shall allow for central processor (CPU) to monitor and control all HVAC systems either from a control location on site or offsite via the internet.
 - 2. The BMS shall be provided by the mechanical HVAC contractor or a subcontractor under his purview. Provide design and shop drawings including schematics, components schedules, and sequences of operations.
 - 3. See Section 230913 for more information.

1.05 ABBREVIATIONS AND DEFINITIONS

When the following abbreviations and definitions are used in relation to the work for Division 23 they shall have the following meanings:

Item	Meaning
Accepted	Reviewed by engineer and AHJ with no exceptions taken to submittal material unless noted. See "Submittal" below.
AHJ	Authorities Having Jurisdiction and Engineer
ANSI	American National Standards Institute
Approved	Inspected and accepted by the Authorities Having Jurisdiction and Engineer.
Architect	Architect or his representatives. Also, the Owner's representative.
Architectural Drawings	Architectural or Interior Drawings
ASTM	American Society for Testing Materials

Code	All code in force for the project and AHJ. If the contract documents denote work in excess of the codes, the Contractor shall install this work per the contract documents as long as code is not violated by his doing so.
Contractor	The Plumbing Contractor
Engineer	Engineer of Record for the discipline
Exterior	Outside of or penetrating the outer surfaces of the building weather protective membrane.
F & I	Furnish and install.
Fully Operational	Tested, accepted and approved and operating to the satisfaction of the AHJ, manufacturer, contract documents, Architect, and Rensch Engineering.
"Provide" "Furnish" "Install" or "Supply"	Purchase, deliver to the jobsite, install and make fully operational.
Mfr.	Manufacturer
Noted	Shown or specified on or in the contract documents
WSEC	Washington State Energy Code
Owner	Owner or their representatives (Salacia)
Required	As required by code, AHJ, Architect, Engineer, and contract documents for the particular installation, and in addition, all items needed to be fully operational (in the Engineer's opinion).
Shop Drawing	AutoCAD drafted document which fully details and dimensions the equipment and intended installation relative to this specific project. Manufacturer's "catalog" drawing is not acceptable. Provide AutoCAD compatible disk to engineer with shop drawing. Scale shall be indicated on drawing.
Shown	As indicated on the Architectural or other drawings or details or specified or needed to be fully operational.
Submittal	Any material for Engineer review which may contain catalog cuts, shop drawings, wiring diagrams, etc., of the actual material being furnished.
Whichever is more stringent	Whichever is more stringent in the opinion of the Engineer.

1.06 DRAWINGS AND SPECIFICATIONS

A. Construction Drawings and Specifications:

1. Construction Drawings and Specifications shall be provided by the owner or their representative for use of the contractor during construction. These drawings are conceptual, diagrammatic and intended to provide a basis of design and detailed direction to contractors during the bidding, subsequent coordination, and finalization of installed component process. They will also provide the functional targets and owner's expectations for all systems installed at the facility. Drawings that depict actual pipe routing, hanging methods, coordination with structural and other trades are all in the purview of the plumbing contractor in the form of Pre-Construction Shop Drawings. For additional details, the Contractor is referred to the site and to the Architectural and other trade drawings. If perceived errors, omissions, or conflicts between the above drawings and/or Specifications occur, the Contractor shall obtain clarification from the Architect prior to bidding.
 2. The MC shall use the Construction Set to plan layouts, coordinate, and install equipment, ducts, piping, wiring, etc. with the Architect, other contractors and the owner.
 3. All working measurements shall be taken from the actual field dimensions and verified against those shown on the construction drawings, and if they are found to vary from the latter, the Contractor shall report the same to the Architect at once and make adjustment before proceeding with this portion of his work. This shall not be construed as a "stop work" order. Failure to comply with this instruction shall result in HVAC Contractor being required to alter the work at the direction of the Architect and at the HVAC Contractor's expense.
 4. The Construction Set and these specifications may be supplemented from time to time by diagrams from the Architect and/or details as required for the proper understanding, execution and completion of the work, and all such additional drawings shall be considered as forming a part of the contract at no additional charge from the contractor. Drawings of a later date shall always have precedence over previous drawings.
- B. Shop Drawings:
1. Shop Drawings depicting complex and detailed installations of mechanical components and systems shall be developed as necessary by the MC for coordination with the Architect, other contractors and the Owner. The Owner reserves the right to request Shop Drawings from the MC if deemed necessary for coordination of installed systems.
- C. Construction Phase Contractors Drawings:
1. The Mechanical Contractor shall provide a set of red-lined Contractor Drawings on site during the construction phase of the project which shall notate and depict changes in systems routing, points of connection, sizes and capacities, substitutions, and deviations from the construction plans that have been executed during the construction phase. Additions and changes in drawings shall be indicated by clouds with date of notation or entry. These Drawings shall be available for viewing by the GC, Mechanical EOR and Architect as requested.
- D. As-Built Drawings:
1. At the completion of work and as part of the closeout documentation the contractor shall provide 2 sets of hard copies and a complete electronic file of all drawings in PDF format with legible and accurate redline changes submitted for approval. These drawings shall include but not be limited to the following requirements:
 - a. Floor plans enlarged area plans and roof plans as included in the original construction drawing set.
 - b. Sections and details as needed to depict actual installation of equipment, piping, controls and clearances for service & from combustibles.
 - c. Location of all motorized dampers including:
 - 1) Isolation dampers
 - (a) Fire and combination smoke/fire dampers
 - 2) Changeover and mixing dampers

- 3) Service access points of all installed mechanical equipment. These shall include control & line voltage electrical cabinets and/or panels, filter change locations and locations where the removal of system components such as motors or coils requires special clearances or worker access.
- 4) Equipment schedule changes where approved substitutions occurred. Schedule notations for approved alternates shall include all schedule fields.

1.07 CODES AND ORDINANCES

- A. Work shall comply with all applicable federal, state, county and local codes, ordinances and policies, the contract documents, and AHJ. Contractor shall make application and pay for any needed or required inspections and permits, drawing reviews, and all other items. Compliance with the above shall be at the HVAC Contractor's expense and at no additional charge. Field changes and/or code corrections required by AHJ shall be made at HVAC Contractor's expense.

1.08 SUBMITTALS

- A. See Section 01 3300 for submittal procedures and additional requirements.
- B. Product Submittals:
 1. Submit documents per all requirements of the Architectural sections in addition to the following:
- C. Mechanical Equipment Product Submittals:
 1. A complete equipment list by specification section of the equipment proposed to be installed, stating the type of equipment and its major components by make, model number, manufacturer, and giving full performance data. Provide Indexed PDF submittals – non indexed submittals shall not be reviewed and shall be returned for correction. This shall be in no way construed as allowing the substitution of an item for the items specified herein.
 2. Identified specific product. When more than one size or type of item appears in shop drawings or catalog sheets, the item being submitted shall be identified by arrow, underlining or highlighting and all data not applicable shall be crossed out.
 3. Partial submittals:
 - a. Partial material submittals and/or product submittals will not be considered unless specifically requested by the Mechanical Engineer, Commissioning Authority or Architect.
 4. Submittal format:
 - a. Submittals shall be neatly bound and indexed with Contractor's name, address, and phone number on cover – including the names and contact information equipment supplier, manufacturer, and sub-Contractors associated with each product. Product categorization and identification shall match exactly the identification indicated on plans, schedules and specifications.
 - b. Submittals shall have the General Contractors approval on the cover sheet indicating they have reviewed the submittal and any coordination between contractors has already occurred.
- D. Contractor's comprehensive responsibility
 1. Review of Pre-Construction Shop Drawings or Field Generated Shop Drawings by the Architect or Mechanical EOR shall not relieve the Contractor from being fully responsible for all information contained therein as well as in the Construction Drawings and Specifications. This is also the case as the contractor developed Shop Drawings affect (among others) the jobsite conditions, space requirements, performance requirements, weight, mechanical and electrical requirements. Contractor shall note that drawings are reviewed by the Engineer in meeting "Design Concept" only. The Architect's or Engineer's review shall not absolve the Contractor of their responsibility for conditions and intent of the contract documents.
- E. Unauthorized procurement or fabrication

1. Without prior and product-specific approval to order or fabricate, no procurement or fabrication of products shall be done until return of submittals and all submittal review responses have been accepted and approved by the mechanical engineer of record.
- F. Substitutions:
 1. See the architectural sections for substitution requirements. If unapproved substitute equipment is installed, the Contractor shall be responsible for the engineering cost associated with review and possible redesign. After review, the engineer shall reserve the right to reject the unapproved, installed substitute and require the contractor to remove and install per the original design. All costs for engineering review and possible reinstallation shall be borne by the contractor.

1.09 OPERATION AND MAINTENANCE MANUALS

- A. Contents:
 1. Furnish three (3) bound copies of operating and maintenance manuals to include the following:
 - a. Manufacturers, suppliers, contractor and mechanical sub contractors' names, addresses and phone numbers.
 - b. Warranty service contractors' names, address and phone numbers (if different from above).
 - c. Schedule and description of routine maintenance for each component to include oiling, lubrication and greasing data and belt sizes, types and lengths.
 - d. Balancing log and test data.
 - e. Manufacturer's cuts and rating tables, including brochures for all submittal items.
 - f. Part numbers of all replaceable items.
 - 1) Control diagrams and operation sequence.
 - g. Written guarantees.
 - h. Record drawings corrected and completed.
 2. Binders:
 - a. Furnish typewritten or printed index and tabbed dividers between principal categories.
 - b. Bind each manual in a hard-backed loose-leaf binder.
 - c. Imprint on Cover: Name of job, Owner, location of job, Architect, Engineer, Contractor, year of completion
 - d. Imprint on Cover: Name of job, year of completion

1.10 WARRANTY

- A. Contractor to warrant equipment, labor and installation for one (1) year from date of substantial completion and acceptance by owner. See 017800 for additional requirements.
- B. Where Drawings or other Technical Specification Sections refers to a conflicting length of warranty or starting date for the Contractor's or subcontractor's general material and workmanship warranty, the longer period shall govern.

1.11 PERMITS AND FEES:

- A. The Contractor shall make all arrangements and pay all fees prior to making any connections to utilities and conform to regulations concerning such connections to said utilities. Contractor shall submit copies of signed, approved permits to the Architect upon request. Contractor shall properly protect and support all water, sewer, electric and other services, shall immediately notify bodies owning the same, granting them the opportunity to take such precautions, as they may see fit, and be responsible for all damage to the same caused by his operation.

END OF SECTION 230100

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**SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.
- E. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

- A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- B. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

- A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators 2017.
- B. NEMA MG 1 - Motors and Generators 2021.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. Motors that are components of manufactured HVAC systems such as packaged rooftop units, exhaust fans, and fan coil unit do not need to be submitted for approval since they form an integrated part of an listed, assembled HVAC unit
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
- D. Operation Data: Include instructions for safe operating procedures.
- E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Motors on this project are provided as components of fully assembled listed HVAC systems. As such the manufacturer of the motors shall ensure motors are listed and code compliant both NEC and Energy Code. This includes packaged rooftop units, exhaust fan assemblies, fan coil units, and outdoor condensing units or heat pumps.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service: Refer to Section 260583 for required electrical characteristics.

- B. Electrical Service:
 - 1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
 - 2. Motors Larger than 1/2 Horsepower: 208/230 volts, three phase, 60 Hz.

2.03 APPLICATIONS

- A. Motors on this project are provided as components of fully assembled listed HVAC systems. . This includes packaged rooftop units, exhaust fan assemblies, fan coil units, and outdoor condensing units or heat pumps. The application of motors in these assemblies includes the following:
 - 1. Supply air blowers
 - 2. Exhaust system fans
 - 3. Return and/or Relief fans
 - 4. Condensing coil and/or heat pump fans

2.04 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Manufacturers:
 - 1. Motor provided with factory assembled HVAC equipment.
- B. Applications:
 - 1. Commercial:
 - a. Roof Top Unit:
 - 1) Operating Mode: Constant speed except where variable speed is indicated..
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the roof top unit and/or specified sequence of operation.
 - 3) Shaft Extension: Single.
 - b. DX Fan Coil Unit:
 - 1) Operating Mode: Constant except where variable CFM is indicated..
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the DX fan coil unit and/or specified sequence of operation.
 - 3) Shaft Extension: Single.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Motors have been installed at the factory for all of the following systems and applications:
 - 1. Supply air blowers
 - 2. Exhaust system fans
 - 3. Return and/or Relief fans
 - 4. Condensing coil and/or heat pump fans
- B. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 230513

**SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components.

1.02 RELATED REQUIREMENTS

- A. Section 230548 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured .

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems and nonpenetrating rooftop supports.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of mechanical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 2. Strut Channel or Bracket Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
 4. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
 5. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.
- C. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
 2. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm) diameter.
 - b. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.
- D. Steel Cable:
1. Manufacturers:
 - a. Ductmate Industries, Inc, a DMI Company; Clutcher Cable Hanging System: www.ductmate.com/#sle.
- E. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
 - b. Unistrut, a brand of Atkore International Inc; _____: www.unistrut.com/#sle.
 2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 5. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 230529

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SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

- A. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 DEFINITIONS

- A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

- A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- B. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
- C. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
- E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.06 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- C. Evidence of qualifications for seismic controls designer.
- D. Evidence of qualifications for manufacturer.

1.07 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
 - 1. Designer may be employed by the manufacturer of the seismic restraint products.
 - 2. These calculations may be already available through the structural building engineer. It is the contractor's responsibility to confirm if the design is already complete and if not provide those stamped calculations.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
- D. Equipment Isolation: As indicated on drawings.

2.02 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide HVAC component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor HVAC components.
- B. Seismic Restraints:
 - 1. Provide seismic restraints for HVAC components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 - 2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.

- e. FEMA E-74.
- f. SMACNA (SRM).
- 3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
- 4. Seismic Type Vibration Isolators:
 - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
- 5. External Seismic Snubber Assemblies:
 - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
 - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
- 6. Seismic Restraint Systems:
 - a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - b. Use only cable restraints to restrain vibration-isolated HVAC components, including distributed systems.
 - c. Use only one restraint system type for a given HVAC component or distributed system (e.g., ductwork, piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain HVAC component in all lateral directions; consider bracket geometry in anchor load calculations.
 - e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported HVAC component weight.
 - f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported HVAC component weight.
 - g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
 - h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
 - i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
- 7. Ductwork Applications:
 - a. Provide independent support and seismic restraint for in-line components (e.g., fans, heat exchangers, humidifiers) having an operating weight greater than 75 pounds (334 N).
 - b. Positively attach appurtenances (e.g., dampers, louvers, diffusers) with mechanical fasteners.
- C. Seismic Attachments:
 - 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
 - 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
 - 3. Do not use power-actuated fasteners.
 - 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.

5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
- D. Seismic Interactions:
1. Include provisions to prevent seismic impact between HVAC components and other structural or nonstructural components.
 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
 3. Comply with minimum clearance requirements between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.
- E. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., ductwork, piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.

2.03 VIBRATION ISOLATORS

- A. Manufacturers:
1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
 3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches (3 mm) and 0.25 inches (6 mm) unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch (6 mm) thick; capable of being visually inspected for damage and replaced.
- C. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
 2. Housed Spring Isolators:

- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
- b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
- c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
- d. Furnished with integral leveling device for positioning and securing supported equipment.

2.04 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

- A. Manufacturers:
 - 1. Vibration-Isolated and/or Seismically Engineered Roof Curbs: See plans for scheduled roof curbs.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 4. Adjust isolators to be free of isolation short circuits during normal operation.
 - 5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- F. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch (3 mm), use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch (3 mm) or less.
 - 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.

- b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
- c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Inspect vibration isolation and/or seismic control components for damage and defects.
- B. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- C. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 230548

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.03 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Nameplates.
- C. Thermostats: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Letter Color: White.
- C. Letter Height: 1/4 inch (6 mm).
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com/#sle.
 - 3. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 CEILING TACKS

- A. Manufacturers:
 - 1. Craftmark Pipe Markers; _____: www.craftmarkid.com/#sle.
- B. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
- C. Color code as follows:
 - 1. HVAC Equipment: Yellow.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Locate ceiling tacks in corner of panel that has access to equipment.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Commissioning activities.

1.02 RELATED REQUIREMENTS

- A. Section 230800 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods 2016, with Errata.
- C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
- D. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems 2019.
- E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

- A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit to the Commissioning Authority and EOR.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 4. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - f. Expected problems and solutions, etc.
 - g. Criteria for using air flow straighteners or relocating flow stations and sensors.
 - h. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - i. Specific procedures that will ensure that air is operating at the lowest possible pressures and methods to verify this.

- j. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - l. Method of checking building static and exhaust fan and/or relief damper capacity.
 - m. Proposed selection points for sound measurements and sound measurement methods.
 - n. False loading of systems to complete TAB work, if specified.
 - o. Procedures for formal deficiency reports, including scope, frequency and distribution.
- C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
 - 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in I-P (inch-pound) units only.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
 - 4. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.

3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 1. Running log of events and issues.
 2. Discrepancies, deficient or uncompleted work by others.
 3. Contract interpretation requests.
 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.
- M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- N. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 COMMISSIONING

- A. See Section 230800 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 - 1. Air side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

3.08 SCOPE

- A. Test, adjust, and balance the following all HVAC equipment as scheduled in the plans.

END OF SECTION 230593

SECTION 230713 DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.

1.02 RELATED REQUIREMENTS

- A. Section 230553 - Identification for HVAC Piping and Equipment.
- B. Section 233100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- C. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Johns Manville; _____: www.jm.com/#sle.

2. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
- C. Vapor Barrier Jacket:
 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
- D. Vapor Barrier Tape:
 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.03 DUCT LINER

- A. Manufacturers:
 1. Johns Manville; _____: www.jm.com/#sle.
- B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board; impregnated surface and edges coated with acrylic polymer.
 1. Fungal Resistance: No growth when tested according to ASTM G21.
 2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F (0.045 at 24 degrees C).
 3. Service Temperature: Up to 250 degrees F (121 degrees C).
 4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm (25.4 m/s), minimum.
- C. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated Ducts Conveying Air Above Ambient Temperature:
 1. Provide with or without standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. Duct and Plenum Liner Application:
 1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

END OF SECTION 230713

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SECTION 230800 COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.
- B. The Commissioning Authority or Professional (CxP) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
 - 1. Control system.
 - 2. Major and minor equipment items.
 - 3. Piping systems and equipment.
 - 4. Ductwork and accessories.
 - 5. Terminal units.
 - 6. Other equipment and systems identified elsewhere in Contract Documents as requiring commissioning.
- D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections and the Mechanical Plans.

1.02 RELATED REQUIREMENTS

- A. Section 230593 - Testing, Adjusting, and Balancing for HVAC.
- B. Section 230913 - Instrumentation and Control Devices for HVAC.
- C. Section 230993 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.04 SUBMITTALS

- A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- B. Prefunctional Checklists and Functional Test Procedures for Control System furnished by CxP: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing will be provided to the contractor.
- C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
 - 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
 - 2. Full as-built set of control drawings.
 - 3. Full as-built sequence of operations for each piece of equipment.
 - 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
 - a. Floor.

- b. Room number.
 - c. Room name.
 - d. Air handler unit ID.
 - e. Reference drawing number.
 - f. Air terminal unit tag ID.
 - g. Heating and/or cooling valve tag ID.
 - h. Minimum air flow rate.
 - i. Maximum air flow rate.
- 5. Full print out of all schedules and set points after testing and acceptance of the system.
- 6. Full as-built print out of software program.
- 7. Electronic copy on disk of the entire program for this facility.
- 8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
- 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
- 10. Control equipment component submittals, parts lists, etc.
- 11. Warranty requirements.
- 12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
- 13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
 - a. Sequences of operation.
 - b. Control drawings.
 - c. Points lists.
 - d. Controller and/or module data.
 - e. Thermostats and timers.
 - f. Sensors and DP switches.
 - g. Valves and valve actuators.
 - h. Dampers and damper actuators.
 - i. Program setups (software program printouts).
- E. Project Record Documents:
 - 1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 - 2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- F. Draft Training Plan: include:
 - 1. Follow the recommendations of ASHRAE Guideline 1.1.
 - 2. Control system manufacturer's recommended training.
 - 3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
- G. Training Manuals:
 - 1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cooperate with the Commissioning Authority in performing Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.
- C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
- E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
- G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Provide two-way radios for use during the testing.
- D. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable. The cost for any additional site visits and consultation required by the CxP to resolved/confirm deficiencies have been met and any other related costs by the this contractor (and others) will be borne by the contractor.

3.03 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.
- C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
- D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
- E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

- F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- C. Using a Manufacturer's Representative who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
 - 1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
 - 2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 - 1. Setpoint changing features and functions.
 - 2. Sensor calibrations.
- G. Demonstrate to the Commissioning Authority:
 - 1. That all specified functions and features are set up, debugged and fully operable.
 - 2. That scheduling features are fully functional and setup, including holidays.
 - 3. That all graphic screens and value readouts are completed.
 - 4. Correct date and time setting in central computer.
 - 5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
 - 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
 - 7. Power failure and battery backup and power-up restart functions.
 - 8. Global commands features.
 - 9. Security and access codes.
 - 10. Occupant over-rides (manual, telephone, key, keypad, etc.).
 - 11. O&M schedules and alarms.
 - 12. Occupancy sensors and controls.
 - 13. Fire alarm interlocks and response.
 - 14. Fire protection and suppression systems interfaces.
 - 15. All control strategies and sequences not tested during controlled equipment testing.
 - 16. Trend logging and graphing features that are specified.
 - 17. Other integrated tests specified in Contract Documents
 - 18. That control system features that are included but not specified to be setup are actually installed.

- H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:
 - 1. Sequential staging ON of equipment; optionally demonstrate manually.
 - 2. Optimum start-stop functions.
- I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- B. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

- A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- C. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide 8 hours of training.
- D. TAB Review: Instruct Owner's personnel for minimum 3 hours, after completion of TAB, on the following:
 - 1. Review final TAB report, explaining the layout and meanings of each data type.
 - 2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
 - 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
 - 4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
 - 5. Other salient information that may be useful for facility operations, relative to TAB.
- E. HVAC Control System Training: Perform training in at least three phases:
 - 1. Phase 1 - Basic Control System: Provide minimum of 2 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
 - a. This training may be held on-site or at the manufacturer's facility.
 - b. If held off-site, the training may occur prior to final completion of the system installation.
 - c. For off-site training, Contractor shall pay expenses of up to two attendees.
 - 2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 2 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
 - a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.

- b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
 - c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
 - d. Every display screen, allowing time for questions.
 - e. Point database entry and modifications.
- 3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.
- F. Provide the services of manufacturer representatives to assist instructors where necessary.
- G. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 230800

**SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dampers.
- B. Damper Operators:
 - 1. Electric operators.
 - 2. Inlet vane operators.
- C. HVAC&R Sensors:
 - 1. Temperature sensors.
 - 2. Static pressure (air pressure) sensors.
 - 3. Carbon dioxide sensors.
- D. Thermostats:
 - 1. Electric room thermostats.
 - 2. Line voltage thermostats.
- E. Operator access port (terminal)
 - 1. Carrier I-Vu "Touch" configuration tool

1.02 ALTERNATE CONTROL SYSTEM

- A. The system described herein and in the plans is based on Carrier's I-Vu system with expansion components to control all systems at this building except where noted otherwise. Carrier's I-Vu system (and other controls) shall be the base level control system for bidding.
- B. The contractor shall contact Shawn Ruschner of ATS controls at 206-471-4735 to seek an alternate bid to provide a 100% ATS controlled system including VAV system. The ATS control system shall meet all requirements described herein and shall be equal to the I-Vu system at a minimum. Any additive features shall be broken out separately for owner's review and approval.

1.03 RELATED REQUIREMENTS

- A. Section 233300 - Air Duct Accessories.
- B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- C. Section 262726 - Wiring Devices: Elevation of exposed components.

1.04 REFERENCE STANDARDS

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- B. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats 2013.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- D. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Manufacturer's Instructions: Provide for all manufactured components.
- E. Designer's qualification statement.
- F. Installer's qualification statement.
- G. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
- H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section documented experience approved by manufacturer.

1.08 WARRANTY

- A. Correct defective work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

- A. Carrier I-Vu operating system.
 - 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 Web server interface(s) (I-Vu "Touch") 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.
 - c. 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.
 - d. With the use of a remote SMTP email server the operators interface web server shall be able to notify personnel of an alarm or record information about an alarm in the DDC system.
 - e. Secondary interface, in addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone and tablet devices. As a minimum, the following capabilities shall be provided through this interface:

- 1) Secondary interface with screen resolution 1024x768 and above shall be able to provide a full graphical environment as the primary interface.
 - 2) An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.
 - 3) The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.
 - 4) A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.
 - 5) Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.
2. 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.
 3. 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.
 4. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:
 - a. Log In and Log Out. System shall require user name and password to log in to operator interface.
 - b. 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.
 - c. 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.
 - d. 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.
 - e. 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.
 - f. 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.
 - g. 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.
 - h. 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.

- i. 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.
- 5. System Software.
 - a. Operating System and required software. Web server operator interface shall be a self-contained web server without the need for any type of maintenance.
 - b. System Graphics. Operator interface shall be graphical and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
 - c. 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.
 - d. Animation. Graphics shall be able to animate by displaying different image files for changed object status.
 - e. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
 - f. 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 each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard Windows compatible PCs with no limit on the number of copies that can be installed under the system license.
 - h. 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.
 - i. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.
 - j. System Configuration. Operators shall be able to configure the system.
 - k. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.
 - l. Security. System shall require a user name and password to view, edit, add, or delete data.
 - m. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object.
 - n. 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.
 - o. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
 - p. 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).

- q. 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.
- r. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
- s. 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.
- t. 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.
- u. 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.
- v. 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.
- w. 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.
- x. 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
 - (c) Security Reports – Maintains audit of all actions taken through user interface
 - (d) Commissioning Reports – Provide equipment checkout status and notes
 - (e) Equipment Reports – Provide reports showing trended points and available network points
 - (f) 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.
- y. 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.
 - 1) Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

- z. 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.
- aa. CCN (Carrier Comfort Network) Communication. Web server or workstation shall also support communication using CCN protocol.
- bb. Timed override reporting (i-Vu Plus or Pro only)
- cc. The DDC system shall track all push button timed override events during unoccupied periods. The system shall store time of the override event and time duration for each override event.
- dd. Web server shall allow operators to create custom reports detailing timed override events. Timed override reports shall allow the following options:
 - 1) Minimum billing time. A minimum amount of time that each override event will last.
 - 2) Billing rate. A monetary rate per hour or per minute of the override duration.
 - 3) Exemption times. A defined block of time during each week that is exempt from detecting override events.
 - 4) Allowances. A dollar amount of override usage that is allowed per tenant and is given at no charge. This allowance will be subtracted from the tenant's total override usage.
- ee. Web services data exchange (i-Vu Plus or Pro only) System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the DDC system.
 - 1) System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
 - 2) System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
 - 3) For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.
 - 4) System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.
- ff. Open Protocol Communications (i-Vu Plus or Pro only) DDC system shall allow communication to ancillary systems or controllers, such as lighting system or VFD controllers that utilize BACnet, Modbus, or LonWorks communication protocols. The quantity of data points available per protocol shall be based upon system memory and capacity and will not require the purchase of additional licenses or fees.
 - 1) BACnet communication
 - 2) DDC System shall support BACnet/IP addressing as specified in ASHRAE/ANSI 135, BACnet Annex J using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol.
 - 3) DDC System shall support BACnet MS/TP communications using EIA-485 twisted pair topology running at 9600, 19200, 38400, and 76800 baud.
- gg. Modbus communication
 - 1) DDC System shall support Modbus RTU/ASCII communications over EIA-485/EIA-232 type network at 9600, 19200, 38400, and 76800 baud.
 - 2) DDC System shall support Modbus TCP/IP communications over ISO 8802-3 (Ethernet) Data Link/Physical layer protocol.

- hh. LonWorks communication
 - 1) DDC system shall support LonWorks communication utilizing ANSI/EIA-709.1 communications over FT-10A network.
- ii. Communication between devices shall be via Standard Network Variable Types (SNVTs)
- 6. Carrier I-Vu "Touch"
 - a. Network access and configuration port that allows users to program and monitor points and equipment throughout the I-Vu building network

2.02 DAMPERS

- A. See Section 233300 for dampers and this section for actuators and operators.

2.03 DAMPER OPERATORS

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
 - 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
 - 2. Provide one operator for maximum 36 sq ft (3.34 sq m) damper section.
- B. Electric Operators:
 - 1. Manufacturers:
 - a. Schneider Electric: www.schneider-electric.us/#sle.
 - b. Belimo.
 - c. Kele.
 - 2. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.04 HVAC&R SENSORS

- A. Temperature Sensors:
 - 1. Manufacturers:
 - a. Honeywell.
 - b. Carrier I-Vu.
 - 2. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
 - 3. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F (26 degrees C).
 - 4. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
 - 5. Temperature Sensing Device: Compatible with project DDC controllers.
 - 6. Performance Characteristics:
 - a. RTD:
 - 1) Room Sensor Accuracy: Plus/minus 0.50 degrees F (0.28 degrees C) minimum.
 - b. Thermistor:
 - 1) Accuracy (All): Plus/minus 0.36 degrees F (0.20 degrees C) minimum.
 - 2) Range: Minus 25 degrees F (Minus 13 degrees C) through 122 degrees F (50 degrees C) minimum.
 - c. Temperature Transmitter:
 - 1) Accuracy: 0.10 degree F (0.06 degrees C) minimum or plus/minus 0.20 percent of span.
 - 2) Output: 4 to 20 mA.
 - 3) 0-10 VDC
 - d. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
 - e. Room Temperature Sensors:
 - 1) Construct for surface or wall box mounting.
 - 2) Provide the following:
 - (a) Setpoint reset slide switch with an adjustable temperature range.

- (b) Individual heating/cooling setpoint slide switches.
 - (c) Momentary override request push button for activation of after-hours operation.
 - (d) Analog thermometer.
 - f. Room Temperature Sensors with Integral Digital Display:
 - 1) Construct for surface or wall box.
 - 2) Provide a four button keypad with the following capabilities:
 - (a) Indication of space and outdoor temperatures.
 - (b) Display and control fan operation status.
 - (c) Manual occupancy override and indication of occupancy status.
 - (d) Controller mode status.
- B. Carbon Dioxide Sensors, Duct and Wall:
- 1. Manufacturers:
 - a. Carrier I-Vu.
 - 2. General: Provide nondispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
 - 3. Air Temperature: Range of 32 to 122 degrees F (0 to 50 degrees C).
 - 4. Relative Humidity: Range of 0 to 95 percent (noncondensing).
 - 5. Power Input: Class 2; 12 to 30VDC or 24VAC 50/60 Hz; 100mA max.
 - 6. Calibration Characteristics:
 - a. Automatically compensating algorithm for sensor drift due to sensor degradation.
 - b. Maximum Drift: 2 percent.
 - c. User calibratable with a minimum calibration interval of 5 years.
 - 7. Construction:
 - a. Sensor Chamber: Noncorrosive material for neutral effect on carbon dioxide sample.
 - b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
 - c. Housing: High impact plastic.
 - 8. Optional Equipment
 - a. Temperature Sensor:
 - 1) Solid state, integrated circuit; Accuracy: Plus/minus 1 degree F (0.5 degrees C); Resolution: 0.2 degrees F (0.1 degrees C); Output Range: 50 to 95 degrees F (10 to 35 degrees C).

2.05 THERMOSTATS

- A. Electric Room Thermostats:
 - 1. Manufacturers:
 - a. Honeywell.
 - b. Equipment Manufacturer Standalone .
 - c. Carrier I-Vu.
 - 2. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
 - 3. Service: Cooling and heating.
- B. Line Voltage Thermostats:
 - 1. Manufacturers:
 - a. Honeywell.
 - 2. Integral manual On/Off/Auto selector switch, single or two pole as required.
 - 3. Dead Band: Maximum 2 degrees F (one degree C).
 - 4. Cover: Locking with set point adjustment, with thermometer.
 - 5. Rating: Motor load.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that systems are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.

- C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- E. Ensure installation of components is complementary to installation of similar components.
- F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner and Commissioning Professional.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.04 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.
- C. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.
- D. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
- E. Install in accordance with manufacturer's instructions.
- F. Check and verify location of thermostats and sensors with plans and room details before installation. Locate 60 inches (1500 mm) above floor. Align with lighting switches; see Section 262726.
- G. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- H. Provide mixing dampers of opposed blade construction arranged to mix streams.
- I. Provide isolation (two position) dampers of parallel blade construction.
- J. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- K. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- L. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
 - 1. Wall mounted devices at a minimum shall be installed in junction boxes and provide with conduit through wall interiors to prevent mechanical damage. The mechanical contractor is responsible for the procurement and installation of all boxes, conduits, wiring, and associated materials pertinent to the DDC (Carrier I-Vu) control system.
 - 2. Conduits from wall mounted devices may terminate in a j-bend configuration above ceiling where there is no risk of mechanical damage.
 - 3. Exposed wiring shall be all plenum rated cables and installed by the mechanical contractor.
 - 4. Exposed wiring shall be properly supported in ceiling spaces and installed in a neat, organized, and workmanlike manner. Avoid stretching wires and running exposed cabling more than 5 ft without support from building and structural components.

3.05 MAINTENANCE

- A. Provide a separate maintenance contract for specified maintenance service.
- B. Provide service and maintenance of control system for one year from Date of Substantial Completion.
- C. Provide complete service of controls systems, including call backs, and submit written report of each service call.
- D. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.
- E. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

END OF SECTION 230913

SECTION 230993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
 - 1. Air terminal (VAV) systems
 - 2. Constant Volume HVAC Units
 - 3. Elevator machine rooms
 - 4. Exhaust, Supply, & Transfer Fans
 - 5. Electric Wall heaters
 - 6. Server Room Systems

1.02 RELATED REQUIREMENTS

- A. Section 230913 - Instrumentation and Control Devices for HVAC.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ROOFTOP PACKAGED UNITS (RTU-101 & 201):

- A. Morning Warmup:
 - 1. The control will provide a Morning Warm-up cycle the first time the system transitions from unoccupied to occupied and if heating is required. Whenever the unit enters the heating mode, before any heat stage is enabled, the control will provide a Linkage mode to the system that will cause the terminals to maintain sufficient airflow. The Linkage mode of Warm-up (2) will be sent to the terminal system to ensure sufficient airflow while in the heating mode but also providing a controlled warm-up cycle to prevent overheating of some zones. As a safety measure, should the heating cycle continue and the SAT approach the "Maximum Heating SAT" limit, the Linkage mode sent will change to Pressurization (6) to ensure all terminals open to their maximum airflow. The Linkage mode will remain Pressurization until that heating cycle ends. Once the heating demand is met and the heat cycle is complete or if cooling is required, heating will be locked out until the beginning of the next occupied period.
 - 2. Following morning warm up, RTU will operate in heating or cooling mode as needed to maintain 55 degrees F discharge temperature.
- B. Supply Air Temperature Control (w/ optional Reset function)
 - 1. Duct Static Pressure Control (w/ optional Reset function): The supply fan VFD will be controlled using a PID and an analog input from a duct static pressure transducer. The supply fan will modulate its speed to maintain the desired duct static pressure setpoint.
 - 2. The control will maintain the desired supply air temperature setpoint whenever cooling is required. A user configurable setpoint will be provided (default 55°F). The control will use the appropriate method (economizer cooling, mechanical cooling, or a combination of both) to achieve this setpoint whenever the zone temperature is greater than the current cooling setpoint (occupied or unoccupied). If Supply Air Reset is enabled, the reset algorithm will calculate a proportional reset value between the Occupied Cooling setpoint and 1°F above the Occupied Heating setpoint. The amount of reset (reset ratio and maximum reset limit value) is user configurable.
- C. Occupied Heating
 - 1. Optionally, the user may enable occupied heating which will allow heating whenever heating is needed during the occupied period. The cycle will operate exactly the same as Morning Warm-up above, except it will not be limited by the transition into an occupied period.

2. Heating and Cooling Setpoint Separation – By default, the control will maintain a minimum 5 deg F (configurable) separation between the heating and cooling setpoints. This will prevent the unit from prematurely entering the opposite mode.
- D. Economizer Cooling Cycle
1. The VAV-RTU shall provide variable supply airflow to the VAV system and maintain constant minimum ventilation. As the supply airflow changes, the economizer minimum position is adjusted to provide a constant amount of outdoor air. The control will provide the ability to utilize outdoor air for maintaining the supply air setpoint should the outdoor air be suitable. The economizer control will utilize an OAT temperature check, a RAT temperature check (when RAT is available) or a SAT temperature check comparison and optionally, an OA enthalpy check to determine if OA conditions are suitable for economizing. Economizer operation, if outside conditions are good, will begin whenever cooling is required. The economizer will modulate the position of the OA damper to maintain the desired calculated economizer setpoint. The economizer will be controlled to so that it will remain open 100% during integrated cooling and only partially close if required. The VAV-RTU also provides FDD (Fault Detection and Diagnostics) for economizer operation. The FDD logic will detect an economizer that fails to close, fails to open, is stuck fully open, and fails to fully open. Each condition will cause an Economizer Operation alarm to occur and the specific fault condition will be displayed.
- E. Mechanical Cooling Cycle
1. The control will operate three stages of mechanical cooling in order to maintain the desired supply air temperature whenever economizer cooling operation is unavailable, but cooling is required. This condition will be determined if the OA has high enthalpy or at a temperature above the Economizer Lockout temperature. The two compressors will be staged in a binary fashion so that three stages of cooling are provided. Mechanical cooling stages will be added as required to meet the desired SA setpoint. The number of stages will depend on the return air conditions and the system load (airflow through the coil). Stages will be added or dropped as required to maintain the setpoint while also maintaining the minimum on time and minimum off time for compressor operation. Anytime the SA falls below the desired SA setpoint, stages will be dropped until only stage 1 is operating. At that point, should the SA fall below 50°F, the economizer will modulate to increase the amount of outdoor air in order to maintain this minimum SA temperature. Should the economizer reach the maximum OA position and if the SA is still below the minimum SA temperature, the 1st cooling stage will be disabled and the economizer will return to the minimum position.
- F. Integrated Cooling Cycle
1. If economizer cooling operation is insufficient to maintain the desired SA setpoint, mechanical cooling will be activated to supplement the free economizer cooling. This condition will be determined if the OA has low enthalpy but is at a temperature at least 5°F above the desired SA setpoint and below the Economizer Lockout temperature. Mechanical cooling stages will be added as required to meet the desired SA setpoint. The number of stages will depend on the return air conditions and the system load (airflow through the coil). Stages will be added or dropped as required to maintain the setpoint while also maintaining the minimum on time and minimum off time for compressor operation. Anytime the SA falls below the desired SA setpoint, stages will be dropped until only stage 1 is operating. At that point, should the SA fall below the minimum SA temperature, the economizer will modulate to increase the amount of return air in order to maintain this minimum SA temperature. Should the economizer reach the minimum OA position and if the SA is still below the minimum SA temperature, the 1st cooling stage will be disabled.
- G. Minimum Ventilation

1. The economizer minimum position will be adjustable as required based on the supply fan speed. Two user configurable minimum economizer positions will be provided. The economizer will be positioned at the "Low Fan Econ Min Pos" when the fan is operating at its slowest speed. When the fan is operating at its maximum speed, the economizer will be positioned at the "Vent Damper Pos / DCV Min Pos". For any supply fan speed between these two points, the economizer minimum position will be calculated proportionally.
- H. Unoccupied Free Cooling
1. Unoccupied Free Cooling allows the rooftop with the economizer damper to use outdoor air for free cooling during unoccupied periods. When the VAV-RTU is unoccupied and the space temperature rises at least 2°F (above the Occupied Cooling Setpoint) the supply fan starts. The economizer damper opens as necessary to maintain the Supply Air Setpoint and cool the space. The VAV-RTU continues to operate in this mode until the space temperature drops to 1°F below the Occupied Cooling Setpoint or the outside air conditions are no longer suitable for free cooling.
- I. Demand Controlled Ventilation [DCV]
1. Whenever the unit is in an occupied mode and "DCV Control" is set to enable, a unique economizer minimum position will be calculated based on the output of the DCV algorithm. The algorithm monitors the CO2 sensor(s) value and compares that value to the user defined setpoint. A control algorithm calculates the required minimum economizer position required to satisfy the ventilation requirements of the space with high CO2 readings. A user adjustable DCV Max Vent Damper Position is provided to limit the maximum amount of outdoor air that can be brought into the unit due to the DCV algorithm. Demand Controlled Ventilation can be used in either a differential mode where both the indoor air and outdoor air CO2 levels are provided to the control or it may be used in a single indoor air mode with only the indoor air CO2 level. In the latter case, the outdoor air CO2 level is assumed at 400 ppm.
- J. Supply Air Tempering (Low and Medium Gas Heat only)
1. The VAV-RTU provides the capability to operate the optional electric heat, if equipped, to maintain a minimum supply air temperature during conditions where very cold outdoor air causes the supply air temperature to fall below the configured Supply Air (SA) Tempering Setpoint. This occurs during periods where DCV is active and increasing the amount of outdoor air or in cases where the system is operating at very low airflow and the calculated economizer position has increased to maintain a constant ventilation rate. Heat operation is subject to anti-recycle timers to protect the equipment from short-cycling. There are fixed application specific minimum on and off times for each heating output (120 seconds on and 60 seconds off). The minimum on time required may adversely affect supply air temperatures with High Gas Heat option in some applications.
- K. Open Airside Linkage

1. The control will support Airside Linkage to accommodate system operation using Carrier VAV terminal controls. The VAV-RTU will receive zone information (occupancy status, occ & unoccupied zone temperatures, occ & unoccupied heating and cooling setpoints, zone CO2 level for DCV, and zone RH level). The VAV-RTU Open will operate in the mode required to satisfy the zones. Airside Linkage will provide operating mode information to the zones so that the system operation is fully coordinated between the rooftop and the terminal zones. The VAV air terminals offer a minimum airflow setting in AHU heating mode. This shall be configured to maintain the required airflow (CFM) whenever the VAV RTU is in a heating mode per the unit's specification. The VAV terminals will recognize the Heating or Warm-up modes as a heat mode and utilize the higher airflow minimum setpoint as configured. For heating cycles, initially utilize the Linkage Morning Warm-Up mode to open dampers on all zones below the midpoint of the occupied heating and cooling setpoints. This provides a controlled heat cycle and prevents the overheating of random zones where heating may not be required. Any zone below this middle setpoint will have its airflow at the maximum value. Further monitor the SAT of the VAV RTU to determine if the SAT is approaching the configured maximum limit. As the limit is approached, the Linkage mode is changed to Linkage Pressurization to ensure all terminals open to their maximum airflow.
- L. Field Test/Commissioning
 1. The control will provide BACnet test points to activate specific test modes that can be used to commission the rooftop and the system. Test modes will be available in the Service Test screen on the Property pages and shall also be available on the local Equipment Touch device for standalone commissioning. Tests include: Fan Test, Low Heat Test, High Heat Test, Cooling Test, Power Exhaust Test, and an Economizer Test. When any test is active, the appropriate Linkage mode will be sent to the system's terminals. This will ensure appropriate system operation and airflow during any test mode.

3.02 AIR TERMINAL UNITS (VAV TERMINALS)

- A. Single-duct VAV Terminals with and without Electric Reheat
 1. Single duct VAV terminals are cooling only with no fan.
 2. On no calls for heating or cooling, primary air shall be reduced to minimum levels while still providing ventilation air (see schedule) to the space served.
 3. On a call for cooling, the terminal primary air damper shall modulate to achieve and maintain the space temperature sensor occupied cooling setpoint. Once setpoint is achieved, primary air damper shall modulate back to its minimum ventilation position.
 4. On a call for heating (where indicated), the terminal primary air damper shall remain at minimum ventilation level and electric resistance heat shall turn on until the space setpoint is achieved and then turn off.
 5. During unoccupied periods the space thermostat shall reset the cooling temperature target to 10 degrees higher than the occupied setpoint.
- B. Fan Powered VAV (FPVAV) Terminals with Electric Reheat
 1. FPVAV (Series Fan Powered) units include a primary air damper, recirculation fan, and electric inline heater.
 2. The recirculation fan shall run constantly during occupied mode and intermittent during unoccupied mode as needed.
 3. On no calls for heating or cooling, primary damper shall remain at minimum position while providing ventilation air (see schedule) to the space served.
 4. On a call for cooling, the terminal primary air damper shall modulate to achieve and maintain the space temperature sensor occupied cooling setpoint. Once setpoint is achieved, primary air damper shall modulate back to its minimum ventilation position.
 5. On a call for heating, the primary air damper shall remain at the minimum ventilation position and the inline electric heater shall be cycled on and off to achieve and maintain the space thermostat occupied heating setpoint.
 6. During unoccupied periods the space thermostat shall reset the heating temperature target to 10 degrees lower than the occupied setpoint and shall reset the cooling temperature target to 10 degrees higher than the occupied setpoint.

3.03 CONSTANT VOLUME SINGLE ZONE HVAC SYSTEMS (RTU-102, 202, & 203)

- A. Occupied Mode:
 - 1. Morning Warmup: The control will provide a Morning Warm-up cycle prior to the occupied set time. During this mode, outside air dampers will remain closed until the occupied set time and heating or cooling sections will operate to meet the upcoming occupied set point based on initial space temperatures.
 - a. In the occupied mode the unit fan shall run continuously.
 - b. Economizer dampers shall be in minimum ventilation position (see schedule) when there are no calls for heating or cooling
 - c. Heat Call: Economizer dampers shall remain in minimum ventilation position and the gas fired heating components shall be cycled to achieve and maintain the occupied heat setpoint.
 - d. Cooling Call: Economizer controller shall reference the outdoor air temperature (OSAT) and when the OSAT is less than 60 Deg F (adjustable) the unit mechanical cooling shall be locked out and the economizer dampers shall modulate to maintain a mixed air temperature of 58 Deg F (adjustable). When the OSAT rises above 60 Deg F (adj.), stage 2 of cooling shall be energized. Stage 2 cooling engages the mechanical cooling components (compressors) along with economizer operation and shall be cycled to achieve and maintain the space thermostat occupied cooling setpoint. Mechanical cooling stages will be added as required to meet the desired space setpoint.
 - 2. DCV Operation:
 - a. In the occupied mode, RTU-102 will function in DCV mode when the space is occupied. The economizer minimum position setting will be set for minimum DCV position. When CO2 levels rise above 800 ppm, the DCV controls shall proportionately ramp up to maximum DCV ventilation rate with a corresponding CO2 level of 1200 ppm. Ventilation rate shall proportionately ramp down as CO2 levels decrease and return to minimum DCV ventilation at a reading less than 800 ppm.
 - b. At any time the economizer controls may override the DCV controls and open up outside air dampers to for economizer operation.
- B. Unoccupied mode:
 - 1. In the unoccupied mode the unit fan shall run intermittently on calls for heating or cooling.
 - 2. Heat Call: Economizer dampers shall remain in closed (0% OSA) position and the gas fired heating components shall be cycled to achieve and maintain the unoccupied (night setback) heat setpoint.
 - 3. Cooling Call: Economize dampers shall open if appropriate outside air temperatures and compressors shall cycle as needed to meet the unoccupied cooling setpoint.
 - 4. The DCV function is not used in the unoccupied mode.

3.04 ELEVATOR MACHINE ROOMS

- A. Ductless wall mounted heat pump unit will be used to provide cooling and heating to the elevator machine room. The systems shall operate on a 24/7/365 basis with no occupied and unoccupied modes of operation.
- B. The system will be controlled by a standalone thermostat located in the elevator machine room with setpoints per the elevator code.
- C. The HVAC system shall be cycled on and off to achieve and maintain the elevator machine room thermostat setpoints.

3.05 EXHAUST, SUPPLY, AND TRANSFER FANS

- A. Exhaust fans:
 - 1. Exhaust fans located in zones served by RTU's shall be controlled such that when the RTU is in occupied mode, the exhaust fans run continuously.
 - 2. When the RTU is in unoccupied mode, associated exhaust fan(s) shall be off.
- B. Supply Fan- Entry Vestibule:

1. Supply fan shall be controlled such that when the lobby RTU is in occupied mode, the fan runs continuously and anytime when the outdoor temperature drops below 45 degrees F.
 2. All other times the fan shall remain off.
- C. Transfer fan- Audio Room:
1. Transfer fan located in the Aqua Room shall be controlled such that when the rooftop supply fan at the RTU is operating, the transfer fan also runs.
 2. When the RTU supply fan is off the associated transfer fan shall be off

3.06 ELECTRIC WALL HEATERS

- A. Electric Wall Heaters: Electric heaters shall be provided and installed with a factory thermostat mounted at the heater cabinet. The space temperature can be set manually at the heater and shall be set at 55 degrees F for freeze protection only.

3.07 SERVER ROOM HVAC SYSTEMS

- A. Two sets of redundant, 2-head ductless wall mounted heat pumps units are used to provide cooling only to the server room. The systems shall operate on a 24/7/365 basis with no occupied and unoccupied modes of operation.
- B. The systems will be controlled by standalone thermostats (2) located in the server room.
- C. The systems shall be installed with lead/lag capability and shall be lead and lag cycled at regular time intervals determined by the owner.
1. The pairs of ductless heads shall be cycled in 2 stages of cooling:
 2. Stage 1 cooling: The lead units shall be cycled simultaneously to maintain the server room thermostat cooling setpoint.
 3. Stage 2 cooling: In the event that the room temperature rises 4 degrees (adj.) above the thermostat cooling setpoint, stage 2 lag units shall be cycled on to maintain the room temperature at 3 degrees above the thermostat setpoint.
 4. A room temperature sensor shall be installed. This sensor shall be set to alarm if the temperature reaches 2nd stage cooling setpoint temperature. If alarmed, the control system shall post an alarm notification and send a text to the owner's building personnel.
- D. Server room HVAC systems shall be interlocked with the fire suppression systems in this space to shut-down the HVAC systems when the fire suppression system is alarmed. Coordinate with the fire suppression system contractor.

END OF SECTION 230993

**SECTION 231123
FACILITY NATURAL-GAS PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

- A. Section 230548 - Vibration and Seismic Controls for HVAC.
- B. Section 230553 - Identification for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
- B. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators 2019.
- C. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators 2019.
- D. ANSI Z223.1 - National Fuel Gas Code 2021.
- E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- F. ASME B31.1 - Power Piping 2022.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.04 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

3. Mechanical Press Sealed Fittings: Double pressed type and approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Viega LLC; MegaPress: www.viega.us/#sle.
- B. Flexible Gas Piping:
 1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
 2. Comply with ASTM E84.
 3. Fittings: Provided by piping system manufacturer.
 4. Manufacturers:
 - a. Omega Flex, Inc; TracPipe CounterStrike: www.omegaflex.com/#sle.

2.02 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
- B. Flanges for Pipe Size Over 1 Inch (25 mm):
 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.03 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 4. Vertical Pipe Support: Steel riser clamp.

2.04 BALL VALVES

- A. Manufacturers:
 1. Milwaukee Valve Company; _____: www.milwaukeevalve.com/#sle.
 2. Nibco, Inc; _____: www.nibco.com/#sle.
- B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, ductile iron, or _____ body, 304 stainless steel, chrome plated brass, or _____ ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded or _____ ends with union.

2.05 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

- A. Manufacturers:
 1. Maxitrol Company; _____: www.maxitrol.com/#sle.
- B. Compliance Requirements:
 1. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.
- C. Materials in Contact With Gas:
 1. Housing: Aluminum, steel (free of non-ferrous metals).
 2. Seals and Diaphragms: NBR-based rubber.
- D. Maximum Inlet Operating Pressure: 10 psi (68.9 kPa).
 1. Line Pressure Regulator: 10 psi (68.9 kPa).
- E. Maximum Body Pressure: 10 psi (1000 mbar).
- F. Output Pressure Range: 1 inch wc (2.5 mbar) to 80 inch wc (200 mbar).

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; refer to Section ____.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- N. Sleeve pipes passing through partitions, walls and floors.
- O. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

3.03 APPLICATION

- A. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.04 SERVICE CONNECTIONS

- A. Provide new gas service complete with gas meter and regulators in accordance with Gas Company requirements. Gas service distribution piping to have initial minimum pressure of 2 psi (14 kPa). Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

END OF SECTION 231123

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**SECTION 233100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Flexible ducts.
- C. Air plenums and casings.

1.02 RELATED REQUIREMENTS

- A. Section 230548 - Vibration and Seismic Controls for HVAC.
- B. Section 230713 - Duct Insulation: External insulation and duct liner.
- C. Section 233300 - Air Duct Accessories.
- D. Section 233600 - Air Terminal Units.
- E. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. ICC (IMC) - International Mechanical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.
- G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
- H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide data for duct materials.

1.05 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Provide metal duct unless otherwise indicated.
- C. Acoustical Treatment: Provide sound-absorbing liners for metal-based ducts in compliance.
- D. Seismic Restraint: Fabricate in compliance with ICC (IMC) requirements.
- E. Duct Sealing and Leakage in accordance with Static Pressure Class:
 - 1. Low Pressure Service: Up to 2 in-wc (500 Pa):
 - a. Seal: Class C, apply to seal off all transverse and longitudinal joints and seams .

2. Low Pressure Service: From 2 in-wc (500 Pa) to 3 in-wc (750 Pa):
 - a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
- F. Duct Fabrication Requirements:
 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 3. Construct tee's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
 4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
 5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.02 METAL DUCTS

2.03 METAL DUCTS

- A. Material Requirements:
 1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Round Spiral Duct:
 1. Round spiral lock seam duct with galvanized steel outer wall.
- C. Connectors, Fittings, Sealants, and Miscellaneous:
 1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
 2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - b. VOC Content: Not more than 250 g/L, excluding water.
 - c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
 - d. For Use with Flexible Ducts: UL labeled.
 3. Gasket Tape:
 - a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
 4. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.04 FLEXIBLE DUCTS

- A. Flexible Air Ducts:
 1. UL 181, Class 1, polyethylene film supported by helically wound spring steel wire.
 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 3. Pressure Rating: From 10 in-wc (2.50 kPa) to 5 in-wc (1.25 kPa) negative.
 4. Maximum Velocity: 5,500 fpm (27.9 m/s).
 5. Temperature Range: Minus 20 to 250 degrees F (Minus 28 to 121 degrees C).
 6. Manufacturers:
 - a. Flexmaster USA, a brand of Masterduct, Inc; Type 1: www.flexmasterusa.com/#sle.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.

- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Flexible Ducts: Connect to metal ducts with adhesive.
- G. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.
- H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- I. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with a crimp in the direction of airflow.
- J. Use double nuts and lock washers on threaded rod supports.
- K. Connect terminal units to supply ducts directly or with one foot (300 mm) maximum length of flexible duct. Do not use a flexible duct to change direction.
- L. Connect diffusers boots to low-pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
- M. At exterior wall louvers, seal duct to louver frame and install blank-out panels.
- N. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 233300, 233600, and 233700.
- O. Duct Insulation: Provide duct insulation in compliance with Section 230713.

3.02 CLEANING

- A. Clean thoroughly each duct system.
- B. Clean the duct system and force air at high velocity through the duct to remove accumulated dust. Clean half the system at a time to obtain sufficient air. Protect equipment that could be harmed by excessive dirt with temporary filters or bypass during cleaning.

END OF SECTION 233100

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**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Flexible duct connectors.
- D. Volume control dampers.
- E. Low leakage (Class 1A) control dampers.

1.02 RELATED REQUIREMENTS

- A. Section 230548 - Vibration and Seismic Controls for HVAC.
- B. Section 233100 - HVAC Ducts and Casings.
- C. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.
- D. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.04 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
 - 1. Krueger-HVAC, Division of Air System Components; _____: www.krueger-hvac.com/#sle.
 - 2. Ruskin Company; _____: www.ruskin.com/#sle.
 - 3. Titus HVAC, a brand of Johnson Controls; _____: www.titus-hvac.com/#sle.

2.02 BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
 - 1. Nailor Industries, Inc; _____: www.nailor.com/#sle.
 - 2. Ruskin Company; _____: www.ruskin.com/#sle.

2.03 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.04 VOLUME CONTROL DAMPERS

- A. Manufacturers:

1. Nailor Industries, Inc; _____: www.nailor.com/#sle.
 2. Ruskin Company; _____: www.ruskin.com/#sle.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- D. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.
 4. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com/#sle.

2.05 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

- A. Manufacturers:
1. Ruskin Company; CD50: www.ruskin.com/#sle.
- B. Maximum Leakage Allowed: 3 cfm/sq ft at 1 in-wc (15.2 L/sec/sq m at 0.25 kPa) or per the energy code, whichever is less.
- C. Frame:
1. Material: 12 gauge galvanized steel.
 2. Free-area: Single cross section.
- D. Blade:
1. Type: Single-blade rectangle shape.
 2. Operation: Opposed type.
 3. Maximum Individual Blade Height: 8 inches (203 mm).
 4. Material: 12 gauge galvanized steel.
- E. Insulation: Water-resistant sound absorbing material.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts at exterior wall or roof envelope.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
1. See Section 230548.
- F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- G. Provide balancing dampers on high velocity systems where indicated. See Section 233600 - Air Terminal Units.

- H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

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**SECTION 233600
AIR TERMINAL UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct terminal units.
 - 1. Constant-volume units.
 - 2. Variable-volume units.
- B. Fan-powered units.
- C. Booster coils.
- D. Controls for terminal units.

1.02 RELATED REQUIREMENTS

- A. Section 230513 - Common Motor Requirements for HVAC Equipment.
- B. Section 230548 - Vibration and Seismic Controls for HVAC.
- C. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

- A. AHRI 880 (I-P) - Performance Rating of Air Terminals 2017.
- B. ASTM A492 - Standard Specification for Stainless Steel Rope Wire 1995 (Reapproved 2019).
- C. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope 2019.
- D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week before to the start of the work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

1.06 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

- A. Manufacturers:
 - 1. See Construction Documents for scheduled equipment.
- B. General:
 - 1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.

2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
- C. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch (0.76 mm) galvanized steel.
 2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
 3. Unit Discharge: Rectangular, with slip-and-drive connections.
 4. Acceptable Liners:
 - a. 1/2 inch (13 mm) thick, coated, fibrous-glass complying with ASTM C1071.
 - 1) Secure with adhesive.
 - 2) Coat edges exposed to airstream with NFPA 90A approved sealant.
 - 3) Cover liner with non-porous foil.
 - b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.
- D. Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
 2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
 3. Incorporate low leak damper blades for tight airflow shutoff.
- E. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
 2. Coil Casing: 20 gauge, 0.0359 inch (0.92 mm) galvanized steel.
 3. Heating Elements: Nickel chrome, supported by ceramic insulators.
 4. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.
 5. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.
 6. Provide the following additional components, mounted and/or wired within the control enclosure:
 - a. Fused or non-fused door interlocking disconnect switch.
 - b. Mercury contactors.
 - c. Fuse block.
 7. Factory wired, including all limit switches and steps of control as indicated on the equipment schedule, with the SSR (solid-state relay) proportional heat control.
- F. Controls:
1. DDC (Direct-Digital Controls):
 - a. Basis of Design: Carrier I-VU
 - b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
 - c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
 - 1) Occupied and unoccupied operating mode.
 - 2) Remote reset of temperature or CFM set points.
 - 3) Proportional, plus integral control of room temperature.
 - 4) Monitoring and adjusting with portable terminal.
 - d. Room Sensor:
 - 1) Compatible with temperature controls specified.
 - 2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.

2.02 FAN-POWERED SERIES UNITS

- A. Manufacturers:
1. See Construction Documents for scheduled equipment.
- B. General:

1. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.
- C. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch (0.76 mm) galvanized steel.
 2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.
 3. Unit Discharge: Rectangular, suitable for flanged duct connection.
 4. Acceptable Liners:
 - a. 1/2 inch (13 mm) thick, coated, fibrous-glass complying with ASTM C1071.
 - 1) Secure with adhesive.
 - 2) Coat edges exposed to airstream with NFPA 90A approved sealant.
 - 3) Cover liner with non-porous foil.
- D. Primary Air Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid shaft rotating in bearings.
 2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.
 3. Incorporate low leak (2 percent) damper blades for tight airflow shutoff.
 4. Fan(s): Forward curved, centrifugal type.
 5. Fan Motor:
 - a. ECM (Electrically Commutated Motor):
 - 1) Brushless DC controlled by an integrated controller/inverter that operates the wound stator and senses rotor position to electrically commutate the stator.
 - 2) Permanent magnet type motor with near-zero rotor losses designed for synchronous rotation.
 - 3) Designed to maintain 70 percent efficiency over the entire operating range.
 - b. Fan motor shaft directly connected to fan and isolated from unit casing to prevent transmission of vibration.
- E. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
 2. Coil Casing: Minimum 20 gauge, 0.0359 inch (0.92 mm) galvanized steel.
 3. Heating Elements: Open wire, nickel chrome, supported by ceramic insulators.
 4. Integral Control Panel: NEMA 250, Type 2 enclosure, with hinged access door for access to all controls and safety devices.
 5. Provide a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow or electrical interlock to prevent heater operation when fan is not running.
 6. Provide the following additional components, mounted and/or wired within the control enclosure:
 - a. Fused or non-fused door interlocking disconnect switch.
 - b. Mercury contactors.
 - c. Fuse block.
 7. Provide SCR (Silicon Controlled Rectifier) controller.
- F. Electrical Requirements:
1. Single-point power connection.
 2. Equipment wiring to comply with requirements of NFPA 70.
- G. Controls:
1. DDC (Direct-Digital Controls):
 - a. Basis of Design: Carrier I-VU
 - b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
 - c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
 - 1) Occupied and unoccupied operating mode.

- 2) Remote reset of temperature or CFM set points.
- 3) Proportional, plus integral control of room temperature.
- 4) Monitoring and adjusting with portable terminal.
- d. Room Sensor:
 - 1) Compatible with temperature controls specified.
 - 2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are suitable for installation.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. See drawings for the size(s) and duct location(s) of the air terminal units.
- D. Provide ceiling access doors or locate units above easily removable ceiling components.
- E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM).
- F. Do not support from ductwork.
- G. Connect to ductwork in accordance with Section 233100.
- H. Provide minimum of 5 ft (1.5 m) of 1 inch (25 mm) thick lined ductwork downstream of units.
- I. Verify that electric power is available and of the correct characteristics.

3.03 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.04 CLEANING

- A. Vacuum clean coils and inside of units.
- B. Install new filters.

END OF SECTION 233600

**SECTION 233700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rectangular ceiling diffusers.
- B. Slot ceiling diffusers.
- C. VAV (Variable air volume) diffusers.
- D. Registers/grilles:
 - 1. Ceiling-mounted, exhaust and return register/grilles.
 - 2. Ceiling-mounted, supply register/grilles.
 - 3. Wall-mounted, supply register/grilles.
 - 4. Wall-mounted, exhaust and return register/grilles.
- E. Duct-mounted supply and return registers/louvers.

1.02 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. See Construction Documents for schedules.
- B. Shoemaker
- C. Price Industries; _____: www.price-hvac.com/#sle.
- D. Titus, a brand of Air Distribution Technologies; _____: www.titus-hvac.com/#sle.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 233700

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**SECTION 234000
HVAC AIR CLEANING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extended surface retained media filters.
- B. Filter frames and housings.

1.02 REFERENCE STANDARDS

- A. AHRI 850 (I-P) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013 (Reaffirmed 2023).
- B. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013 (Reaffirmed 2023).
- C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).
- D. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 230100 General Mechanical Conditions for submittal procedures.
- B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

- A. American Air Filter Company, Inc; _____: www.aafintl.com/#sle.
- B. Camfil, a company of the The Camfil Group; _____: www.camfil.us/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Comply with the rating requirements in AHRI 851 (SI).

2.03 DISPOSABLE, EXTENDED AREA PANEL FILTERS

- A. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid by corrugated aluminum separators.
 - 1. Frame: Non-flammable.
 - 2. Nominal thickness: 1 inch (25 mm).
- B. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE Std 52.2.

2.04 EXTENDED SURFACE RETAINED MEDIA FILTERS

- A. Media: Class 1 pleated, non-woven cotton fabric, scrim reinforced; supported by welded steel retainer; in 16 gauge, 0.0598 inch (1.52 mm) steel holding frame with corrosion resistant coating.
- B. Minimum Efficiency Reporting Value (MERV): 13, when tested in accordance with ASHRAE Std 52.2.

2.05 FILTER FRAMES AND HOUSINGS

- A. General: Fabricate filter frames and supporting structures of 16 gauge, 0.0598 inch (1.52 mm) galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.
- B. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for 24 by 24 inches (610 by 610 mm) filter media (or other standard size), minimum 2 inches (50 mm) thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install air cleaning devices in accordance with manufacturer's instructions.
- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- D. Provide spare set of filters labeled for each piece of equipment to owner at final closeout.

3.02 SCHEDULES

- A. Air Filter Schedule:
 - 1. Utilize MERV8, 1" filters at all VAV terminals.
 - 2. Utilize MERV13, 2" filters at all rooftop units.

END OF SECTION 234000

**SECTION 260000
GENERAL CONDITIONS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions apply to this Section.
- B. See Division 01 for additional administrative requirements whether specifically callout out or not in this Division. Reference other Divisions as needed for additional requirements.
- C. In general, light fixtures have priority for space requirements. Second is HVAC ducts followed by piping and then conduit.
 - 1. In all cases the Contractor shall use established channels and go through Salacia's General Contractor. Salacia's General Contractor shall contact Engineer.

1.02 SUMMARY

- A. Provide labor and materials required to install, test and place into operation the electrical systems as called for in the Contract Documents, and in accordance with applicable codes and regulations.
- B. Provide labor, materials, and accessories required to provide complete, operating electrical systems. Labor, materials or accessories not specifically called for in the Contract Documents, but required to provide complete, operating electrical systems shall be provided without additional cost to the Owner.

1.03 DESCRIPTION

- A. It is the intention of this Division of these Specifications and the accompanying drawings to describe the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown on the above drawings. The work shall include all materials, devices and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all electrical systems.
Equipment and devices furnished and installed under other Divisions of this specification shall be connected under this Division. Equipment and devices shall be installed to conform to ADA requirements where needed.

1.04 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations and requirements of the utility companies serving the project and the Owner's insurance underwriter.
- B. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the most stringent apply.
- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
- D. All electrical equipment, materials, devices and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, IES, NEC, NEMA, NETA, NFPA, OSHA, SMACNA, UL, and the State Fire Marshal.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, work-person-like manner by competent workpeople. Provide a competent, experienced, full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. Equipment shall be certified for use in State Adopted Code(s) and shall meet State Energy Code.

1.05 DEFINITIONS

Item	Meaning

Accepted	Reviewed with no exceptions taken to submittal material. See "Submittal" below.
AHJ	Authorities Having Jurisdiction and Engineer
ANSI	American National Standards Institute
Approved	Inspected and accepted by the Authorities having Jurisdiction
Architect	Architect or his representatives. Also the Owner's representative.
Architectural	Architectural or Interior drawings Drawings
ASTM	American Society for Testing Materials
Boxes	Outlet, Junction or Pull boxes
Code	All codes in force for the project and AHJ. .If the contract documents denote work in excess of the codes, the Contractor shall install this work per the contract documents as long as code is not violated by doing so.
Contractor	The Electrical Contractor and his subcontractors.
Compression	Compressed using a leverage powered (hydraulic or equivalent) crimping tool, or by nut and ferrule using mechanical force.
EC	Electrical Contractor or his subcontractors
EMT	Electrical Metallic Tubing
Engineer	Engineer of Record for the discipline
Exterior	Outside of or penetrating the outer surfaces of the building weather protective membrane.
F&I	Furnish and install complete with all needed accessories
Fully Operational	Tested and approved and operating to the satisfaction of the AHJ, manufacturer, contract documents and Architect.
"Provide"	Purchase, deliver to the jobsite, install and make fully operational.
"Furnish"	"Install" or "Supply"
ICEA	Insulated Cable Engineers Association
Kcm	Thousand circular mils (formerly MCM)
Mfr.	Manufacturer
NEC	National Electrical Code National Fire Protection Association Publication #70 (latest adopted edition with amendments)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Noted	Shown or specified on or in the contract documents
Owner	Owner or Owner's representatives.(Salacia)
PVC	Polyvinyl Chloride

RGS	Rigid Galvanized Steel
RequiredAs	required by code, AHJ, Architect, contract documents for the particular installation, or needed, to be fully operational.
Shop Drawing	AutoCAD drafted document which fully details and dimensions the equipment and intended installation relative to this specific project. Manufacturer's "catalog" drawing is not acceptable. Provide an AutoCAD compatible disk to engineer with shop drawing. Scale shall be indicated on drawing.
Shown	As indicated on the drawings or details or specified or needed to be fully operational.
Submittal	Any material for Engineer review which may contain catalog cuts, shop drawings, wiring diagrams, etc., of the actual material being furnished.
UL	Underwriters Laboratories, listed.
Whichever is	Whichever is more stringent in the opinion of the engineer.more stringent
Wiring	Raceway, conductors, connections and associated devices and components

1.06 WORK IN OTHER DIVISIONS

- A. See all other divisions of specifications and drawings for other work.

1.07 WARRANTY

- A. Contractor to warrant equipment, labor and installation for one (1) year from date of substantial completion and acceptance by owner. See 017800 for additional requirements.
- B. Where Drawings or other Technical Specification Sections refers to a conflicting length of warranty or starting date for the Contractor's or subcontractor's general material and workmanship warranty, the longer period shall govern.

1.08 SAFETY AND INDEMNITY

- A. Safety: The contractor shall be solely and completely responsible for the safety of their workers based on the conditions of the job site, including ensuring that they do not create an unsafe condition for all persons and property during performance of their work. This requirement will apply continuously and not be limited to normal working hours.
- B. No act, service, drawing review or construction review by the owner is intended to include review of the adequacy of the contractor's safety measures in, on, or near the construction site.

1.09 CODES AND REGULATIONS

- A. If any conflict occurs between the rules of governing agencies and this Specification, the more restrictive is to govern (as interpreted by the Engineer). Nothing in these drawings and specifications shall be construed to permit work not conforming with the governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the before mentioned governing agencies and not contrary to same.
- B. The electrical systems shall be installed based on the following current Standards:
1. NFPA 70 National Electrical Code as adopted and amended by The State of Washington or Local Jurisdiction.
 2. WAC 296-46 Washington Administrative Code.

3. Uniform Building Code International Conference of Building Officials as adopted and amended by the Local Jurisdiction, Local Codes, Regulations, and AHJ.
4. Any and all City or Local ordinances which may be in affect at the time of installation.

1.10 SUBMITTALS

- A. See Section 01 3300 for submittal procedures and additional requirements.
- B. Submit documents per all requirements of the Architectural sections in addition to the following:
 1. Shop drawings of the complete work under each section showing all equipment locations and all technical data needed for the interface of work of other trades. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes.
 2. Mandatory Pre-Installation Shop Drawings. Pre-Installation Shop Drawings are required to be submitted to the Architect, and/or Electrical EOR for approval prior to the installation for the following portions of the project:
 - a. Switchboards.
 - b. Lighting Controls
 3. A complete list by specification section of the equipment proposed to be installed, stating the type of equipment and its major components by make, model number, manufacturer, and giving full performance data.
 4. When more than one size or type of item appears in shop drawings or catalog sheets, the item being submitted shall be identified by arrow, underlining or highlighting and all data not applicable shall be crossed out.
 5. Provide Indexed PDF submittals – non indexed submittals shall not be reviewed and shall be returned for correction, complete at one time as soon as available, but not later than 20 days after award of contract (unless construction schedule dictates a shorter period). Partial submittals will not be considered unless requested by the Architect.
 6. Submittals shall be neatly indexed with Contractor's name, address, and phone number on cover page - including any sub-Contractors. Submit as soon as available, but not later than 10 days after award of contract (unless construction schedule dictates a shorter period).
 7. Review of shop drawings shall not relieve the Contractor of reading and being aware of and responsible for all information contained therein as it affects (among others) the jobsite conditions, space requirements, performance requirements, weight, mechanical and electrical requirements. Contractor shall note that drawings are reviewed in meeting "Design Concept" only. The Architect's review shall not absolve the Contractor of his responsibility for conditions and intent of the contract documents.
 8. No purchase, fabrication or manufacture of products shall be done until return of accepted submittals.
 9. Submittals and/or Shop Drawings are required for:
 - a. Lighting
 - b. Switches, Cover Plates, all Electrical Equipment, etc., not provided under other divisions of the work.
 - c. Fused Switches (All safety switch disconnects shall be fused).
 - d. Motor Controllers and Starters
 - e. Panelboards
 - f. Transformers (if applicable)
 - g. Main Service Panels
 - h. As directed elsewhere in this specification.
- C. Substitutions:
 1. In all cases, no substitution of the listed equipment will be allowed unless the alternate item has been submitted first to the owner for initial approval and then to the Engineer for final approval. No substitutions will be considered until after the bid.

- D. Contract Documents are based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.
- E. Submit proposals to provide substitute materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule. Reimburse Owner for costs associated with the review of the proposed substitution whether substitution is accepted or rejected.
- F. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work and related trades are not permitted.
- G. The proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified and shown on the Drawings.
- H. Proposals for substitutions shall include the following information:
 - 1. A description of the difference between the Contract Document requirements and that of the substitution, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to the other trades.
 - 2. Schematic drawings and details.
 - 3. List of revisions to the Contract Documents that must be made if the substitution is accepted.
 - 4. Estimate of costs the Owner may incur in implementing the substitution, such as test, evaluation, operating and support costs.
 - 5. Statement of the time by which a Contract modification accepting the substitution must be issued, noting any effect on the Contract completion time or the delivery schedule.
 - 6. A statement indicating the reduction to the Contract price if the Owner accepts the substitution. Include required modifications to all related trades.

1.11 PERMITS AND FEES

- A. The Contractor shall obtain and pay for all drawing review fees by all agencies, licenses, permits and inspections required by laws, ordinances and rules governing work. He shall also pay any monies to all utilities and all agencies. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection. Contractor shall submit copies of signed, approved permits to the owner upon request.

1.12 CONTRACT DRAWINGS

- A. Raceways, boxes, miscellaneous items, and ground connections, etc. are shown diagrammatically only and indicate the general character and approximate location. The layout does not necessarily show the total number of raceways, miscellaneous items, boxes or grounds, etc. for the circuits required. The drawings do not necessarily show the actual routing of the raceways. The Contractor shall furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required or needed for the electrical systems. All systems shall be complete, fully operational and fully tested upon completion of the project.
- B. The Contractor shall provide overload elements to suit the actual equipment nameplate current if not included as factory equipment. Advise Engineer/Architect of any equipment changes or substitutions affecting electrical systems. Conform to Substitution Requirements.
- C. Any minor changes (less than 10'-0") in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings shall be made without extra charge, where coordination requires or if so directed by the Architect before or during rough-in.
- D. Contractor shall consult the architectural and other drawings and tables to determine the exact height and location of all electrical equipment whether or not specified herein or whether or not shown on the drawings.

- E. When inserts or sleeves for conductors, cables and/or raceways are required or needed, Contractor shall provide and shall fully coordinate the installation thereof with other trades.

1.13 SITE WORK

- A. Contractor shall pay for and coordinate with general contractor for underground locating service to confirm all existing underground utilities which are in the path of new trenches prior to trenching. Existing pavement, sidewalks, and curbs shall be saw cut (or bored under at owner's option but at Contractor's expense) and patched to match existing. Contractor shall consult with civil engineer for exact type of backfill and compaction requirements. Trenching shall be in planter areas wherever possible and shall not impact existing plants or trees.
- B. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- C. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for the satisfactory completion of the work.

1.14 UTILITY COORDINATION

- A. Coordinate with local utility meter department for approval of meter sockets and sections for all meter locations, including placement and clearance in field prior to rough-in. Obtain meter socket and CT base approval from utility meter department in writing prior to purchase for any meter not located in the Main Switchboard.

1.15 ELECTRICAL EQUIPMENT IDENTIFICATION (NAMEPLATES)

- A. General: Affix prominently on equipment except in finished areas where nameplates shall be inside access panel. Provide nameplates for the following:
 - 1. All motors, motor starters, pushbutton stations, control panels and time switches.
 - 2. Service panels, Disconnect switches, switchboards, panelboards, circuit breakers, contactors and relays in separate enclosures.
 - 3. Wall switches controlling equipment where the controlled devices are not located within sight of the controlling switch.
 - 4. Special electrical systems shall be properly identified at junction and pull boxes, terminal cabinets and equipment racks.
 - 5. Any location the AHJ or code requires.
 - 6. If multiple meters are used, each shall have its own nameplate.
- B. Nameplate Inscription:
 - 1. All nameplates shall adequately describe the function or operation of the identified equipment.
 - 2. designation, voltage and phase of supply, e.g. Panel A 208/120V, 3 phase, 4 wire.
- C. Nameplate Construction:
 - 1. Nameplates shall be laminated phenolic plastic with minimum 3/16" high engraved characters. Background nameplate color shall be black.
 - 2. Nameplates shall be securely fastened to the equipment with No. 4 round-head phillips, cadmium plated steel, self-tapping screws or approved "pop rivets". Contact cement adhesive may only be used for dry locations as approved by the engineer.
 - 3. Motor nameplates may be non-ferrous die-stamped metal; minimum 0.03 inch thick, in lieu of separate phenolic nameplate. Device plates may be identified by engraving directly on the plate. All engraved or stamped lettering shall be filled with contrasting enamel.
- D. Project Nameplate:
 - 1. Provide a project nameplate 3" x 2" stating:
 - a. Project:
 - b. Electrical Engineer: Rensch Engineering

- c. Electrical Contractor:
- d. Year Completed:
- 2. Mount this nameplate in a prominent location in the electrical room.

1.16 ITEMIZED SCHEDULE OF COSTS

- A. Furnish a contract cost breakdown by specification section to the owner to allow evaluation of partial payment requests. Refer to the owner for details, and conform hereto.

1.17 ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

- A. Comply with Architectural specifications O & M requirements. If not listed there, the Contractor shall prepare three copies of O&M manuals for all equipment furnished under Division 26 of the specifications.
- B. The information included must be the exact equipment installed, not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.
- C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. It shall be presented and arranged in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:
 - 1. Equipment manufacturer, make, model number, size, etc.
 - 2. Equipment nameplate data.
 - 3. Description of system configuration and operation including component identification and interrelations.
 - 4. Dimensional and data for specific unit provided.
 - 5. Manufacturer's recommended operation instructions.
 - 6. Manufacturer's recommended lubrication and servicing data including frequency.
 - 7. Complete parts list including reordering information, recommended spares and anticipated useful life. Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.
 - 8. Shop drawings.
 - 9. Wiring diagrams.
 - 10. 24-hour emergency phone number.
 - 11. Copy of all warranties.
- D. Wiring diagrams for each system shall be complete drawings for the specific system installed under contract. "Typical" or "Schematic" line diagrams will not be acceptable unless properly marked to indicate the exact field installation.
- E. Binders:
 - 1. Furnish typewritten or printed index and tabbed dividers between principal categories.
 - 2. Bind each manual in a hard-backed loose-leaf binder.
 - 3. Contractor, year of completion
- F. See Architectural sections of the Specifications for additional O & M Manual requirements.

1.18 INSTRUCTION PERIODS

- A. Within 20 days of substantial completion (unless otherwise requested by the Architect), the Contractor shall demonstrate the electrical systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various electrical systems. This shall take place after substantial completion of the work and after the O&M manuals have been delivered to the Owner and after all tests and final inspection of the work by the Authorities having jurisdiction. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and suppliers representatives.

1.19 FINAL ACCEPTANCE REQUEST

- A. The Contractor shall submit to the Architect, with a copy to the Engineer, a Job Completion Form (form attached in this section) properly filled out prior to the time final acceptance of the electrical work is requested. At this time also submit copies of final inspection certificates and receipts for loose materials turned over to the Owner.
- B. JOB CLOSEOUT PROCEDURE
1. Perform the following procedures for project closeout of electrical portions of work:
 - a. Perform testing, tests and documentation.
 - b. Provide engraved nameplates on electrical equipment.
 - c. Refinish electrical equipment finishes, which are damaged.
 - d. Clean all parts of lighting fixtures.
 - e. Color code junction boxes.
 - f. Provide spare fuses.
 - g. Type panel schedules with actual "as-built" circuit descriptions.
 - h. Number all circuit breakers.
 - i. Obtain final electrical inspection. Include copies in O & M Manual.
- C. JOB COMPLETION FORM
1. PROJECT NAME _____
 - a. PROJECT LOCATION _____
 2. DATE _____
 3. Electrical Inspectors Final Acceptance _____
 4. Copy of Certificate attached _____
 5. _____
 6. Name Agency Date _____
 7. The following systems have been demonstrated to the Owner's
 8. Representative.
 9. Lighting & Power Systems _____
 10. Owner's Rep Date _____
 11. As-Built Drawings _____
 12. Attached Transmitted previously to _____
 13. O&M Manuals _____
 14. Attached Transmitted previously to _____
 15. Test Reports _____
 16. Attached Transmitted previously to _____
 17. The work is complete in accordance with contract documents and authorized
 18. changes except for _____
 - a. _____
 19. AutoCAD files and drawings to Engineer transmitted on: _____
 20. FINAL APPROVAL
 - a. Final approval shall be contingent upon completion of the following:
 21. Execution of Architect's final observation report
 22. Operation and Maintenance Manuals
 23. Operation instruction period
 24. Permit submittals
 25. As-Built drawings
 26. AutoCAD revisions

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. All materials must be new, clean, free from defects, free of damage and corrosion, and not less than the quality herein specified. They shall be designed to ensure satisfactory operation and operation life in the prevailing environmental conditions in which they are being installed.

- B. Products and materials shall not contain asbestos, PCB, or any other material that is considered hazardous by the Environmental Protection Agency or any authority having jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Architect at no additional cost to the owner.
- D. Each type of material furnished shall be of the same make and shall be of the standard products of manufacturers regularly engaged in the production of such materials and shall be the manufacturer's latest standard design.
- E. All materials and equipment installed, including lighting equipment, shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Code Inspectors, AHJ, and the Architect.

2.02 COMPLETE SYSTEMS

- A. All the systems mentioned shall be complete in every detail and fully operational upon completion of the project unless specifically noted otherwise. Mention of certain materials in this specification shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide complete and fully operational systems.

2.03 CONTROL RELAYS

- A. Control relays shall be silent type, in NEMA 1 enclosure (3R for wet locations), 20A contacts, coil voltage matching control circuit voltage (verify prior to ordering). Shall be Square D or approved equal.

2.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle materials in a manner to prevent damage.
- B. Protect equipment from weather and dampness.

PART 3 EXECUTION

3.01 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

- A. All materials and equipment shall be installed in a neat and workmanlike manner by competent specialists for each subtrade. Work shall be installed to the satisfaction of the Architect/Engineer with unsatisfactory work removed and reinstalled to his satisfaction at no extra cost to the Owner.
 - 1. Provide all cutting and patching necessary to install the work specified in this section. Patching shall match adjacent surfaces. No structural members shall be cut without the approval of the Architect/Engineer. Provide all conduits required before the floors and walls are constructed.
 - 2. Provide experienced foreman with a minimum of three years experience working on this type of building placed in charge of this work at all times.

3.02 MANUFACTURER'S INSTRUCTIONS

- A. Where the specifications call for an installation to be made in accordance with manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the owner.
- B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the owner before starting work.

3.03 CONTRACTORS COORDINATION

- A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Architect) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay. Lack of coordination by Contractor that causes rework
- B. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.

- C. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- D. The electrical drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site, and review drawings of other trades to determine conditions affecting the work, and provide such work and accessories as may be required to accommodate such conditions.
- E. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- F. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations accepted by the Architect before proceeding with the installation.
- G. The Drawings show only the general run of raceways and approximate locations of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Architect for review before such alterations are made. Modifications shall be made at no additional cost to the Owner.
- H. Verify with the Architect the exact location and mounting height of outlets and equipment not dimensionally located on the Drawings.
- I. Circuit tags in the form of numbers are used where shown to indicate the circuit designation numbers in electrical panels. Show the actual circuit numbers on the as-built Drawings and on the associated typed panelboard directory card. Where circuiting is not indicated, provide required circuiting in accordance with the loading indicated on the Drawings and/or as directed.
- J. Carefully check space requirements with other trades to insure that equipment can be installed in the spaces allotted.
- K. Wherever work interconnects with work of other trades, coordinate with other trades to insure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (remote ballast, pull boxes, etc.) requiring access in order that the ceiling trade will know where to install access doors and panels.
- L. Consult with other trades regarding equipment so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.
- M. Furnish and set sleeves for passage of electrical risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each electrical riser passing through building surfaces.
- N. Provide firestopping around all pipes, conduits, ducts, sleeves, etc. which pass through rated walls, partitions and floors. Please refer to architectural specification sections.
- O. Provide detailed information on openings and holes required in precast members for electrical work.
- P. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.
- Q. Examine and compare the Contract Documents with the drawings and specifications of other trades, and report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

- R. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of As-Built Drawings.
- S. Furnish services of an experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate work with the work of other trades. No work shall be installed before coordinating with other trades.
- T. Coordinate with the local electric utility company and the local telephone company as to their requirements for service connections and provide all necessary metering provisions, grounding, materials, equipment, labor, testing, and appurtenances.
- U. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- V. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
- W. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
- X. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
- Y. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Architect.
- Z. The Electrical Contractor shall coordinate his work with that of other Contractors and/or other trades doing work on the project and shall examine all drawings and specifications of other trades including (among others) the mechanical, architectural, interiors, civil, and structural for construction details and necessary coordination. Conform to Architectural sections and review all documents in entirety for coordination and possible work instance. Become totally familiar with scope of this project and any existing conditions of the work prior to bidding.
- AA. Obtain submittals and shop drawings of all equipment showing electrical connections of equipment furnished under this and other divisions of the specifications or otherwise necessary. Provide all wiring in accordance with requirements indicated in the submittals at no extra cost.
- BB. Special attention is called to the following items and all conflicts shall be coordinated prior to bid:
 - 1. Door swings to the end that switches will be located on the "strike" side of the door and not located behind doors.
 - 2. so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
 - 3. Location of cabinets, counters and doors so that electrical outlets, lighting fixtures and equipment are clear from and in proper relation to these items.
 - 4. Electrical characteristics (HP, KVA, voltage, phase) of actual equipment furnished under this and other divisions being different from that shown on the electrical drawings.
- CC. The Contractor shall verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utilities. The Contractor will not be paid for relocation of work, cutting, patching and finishing needed for work requiring reinstallation due to lack of coordination prior to installation.

DD. Service disconnect switches, motor controllers (starters), except where factory installed, and wall and disconnect switches needed for mechanical and kitchen equipment shall be furnished and installed by the Electrical Contractor. It shall be the Mechanical Contractor's responsibility and obligation to provide all controls for Mechanical equipment, including, but not limited to, conduit, conductors and miscellaneous needed for complete control systems whether line or low voltage. Mechanical may retain electrical to do this work.

EE. The final connection to all motors shall be wired by the Electrical Contractor.

3.04 EXAMINATION OF THE SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for the satisfactory completion of the work.

3.05 EXCAVATION AND BACKFILL

- A. Provide excavation for the work of this Division (unless coordinated with GC by others prior to bid). Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove from the site excavated materials not required or suitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water, which accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Where necessary to overexcavate due to rock or unstable soils, consult with Civil Engineer of record and/or Architectural sections related to excavations for direction.
- C. Excavate trenches for utilities that will provide the minimum depths of cover as required by code or AHJ from existing grade or from indicated finished grade, whichever is lower.
- D. Trenches should not be placed within ten feet of foundation or soil surfaces, which must resist horizontal forces. If trenches are required in such locations, consult with Civil Engineer of record and/or Architectural sections related to excavations for direction.
- E. Do not backfill trenches until all required tests have been performed and installation observed by the Architect. Comply with the requirements of other sections of the Specifications. Uniformly grade the finished surface.

3.06 CUTTING BUILDING CONSTRUCTION

- A. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc., using skilled tradespeople of the trades required at no additional cost to the Owner.
- B. Do not cut, channel, chase or drill unfinished masonry, tile, etc., unless permission from the Architect is obtained. If permission is granted, perform this work in a manner acceptable to the Architect.
- C. Where conduit or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

- D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.
- E. Obtain permission from the Architect prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut or core concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.
- F. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor, experienced in that particular building trade.
- G. Coordinate with structural engineer and roofing contractor and follow their instructions.

3.07 PENETRATIONS OF FIRE RATED ELEMENTS

- A. Shall be provided with fire stopping material per code such as to retain that rating of the element.
- B. The total area of penetrations shall not exceed the code allowed maximum area.

3.08 PAINTING

- A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished or replaced.

3.09 CLEAN UP

- A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees, and all other people. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes in finished surfaces of apparatus shall be removed and new finish equal to the original applied.
- B. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.
- C. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.
- D. All electrical equipment shall be thoroughly vacuumed and wiped clean prior to energization and at the completion of the project. Equipment shall be opened for observation by the Architect as required.

3.10 DISCONNECT SWITCHES AND MAGNETIC STARTERS

- A. Disconnect switches, magnetic starters, and reduced current/voltage starters (when needed) shall be provided by the Electrical Contractor for all electrical and mechanical equipment as needed unless supplied by equipment manufacturer. Coordinate with elevator supplier to ensure that reduced current starters are used.

3.11 EQUIPMENT CONNECTION

- A. For equipment furnished under this or other Divisions of the specifications, or by Owner, provide complete all electrical connections and devices necessary to serve such equipment and provide required or needed control connections to all equipment so that the equipment is fully operational upon completion of the project. The Contractor shall provide the code required fusible disconnect switch for all equipment, in addition to those shown on the drawings.
- B. Prior to rough-in, obtain submittals and shop drawings for all equipment requiring or needing electrical connections being furnished under this and other divisions of the specifications and by the Owner.

3.12 INTERFACE WITH OTHER TRADES

- A. The Contractor shall continually interface and coordinate the electrical work with the work of other trades.
- B. At each electrical location the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code and Architect are met.

3.13 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- B. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.

3.14 SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and mechanical equipment rooms.
- C. Provide supporting frames or racks for equipment, which is installed in a freestanding position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on electric conduits, raceways, or cables for support.
- F. Electrical equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling). Provide independent support of electrical equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure. Electrical equipment and supports shall not come in contact with work of other trades.

3.15 FASTENINGS

- A. Fasten equipment to building structure in accordance with the best industry practice. All fastenings shall be capable of supporting the loads imposed upon them.
- B. For items, which are shown, as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- C. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels as manufactured by Kindorf or Unistrut are acceptable.

3.16 IDENTIFICATION

- A. Identify electrical equipment with permanently attached nameplates as defined in this division.
- B. Provide an engraved nameplate for each switch controlling loads, which are not local to the switch.
- C. Wherever raceways for future use are terminated outside of the building, stake the location with a 2 foot long, 1 inch x 1 inch wood stake.
- D. See individual sections for additional identification requirements.

3.17 PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Required Listing labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

3.18 EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide concrete pads under all floor mounted electrical equipment. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 1 inch margin around the equipment and supports. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a $\frac{3}{4}$ inch radius. Shop drawings stamped NO EXCEPTIONS NOTED shall be used for dimensional guidance in sizing pads.
- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to backing supports designed to withstand the load applied to them. Toggle bolts installed in gypsum board partitions are not allowed.

3.19 DELIVERY, DRAYAGE AND HAULING

- A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, the Contractor shall be responsible for its proper storage and protection until the time it is required. Pay for all costs of drayage or storage.
- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.20 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost to the Owner.
- B. Take responsibility for work, materials, and equipment until finally inspected, tested and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment to moisture damage in dry, heated spaces.
- C. Provided adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.
- D. Lighting fixture troffers with parabolic reflectors shall be installed with factory mounted plastic protective bags around parabolic reflector assembly. Remove protective bag just prior to occupancy.

3.21 TESTING OF ELECTRICAL SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and Contract closeout. Complete any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when field testing will be performed. Submit completion schedule for review within six months after the notice to proceed by Owner's Representative has been given. Update this schedule periodically as the project progresses.

3.22 OPERATING INSTRUCTIONS

- A. Instruct Owner's operating personnel in proper starting sequences, operation, shutdown, general maintenance and preventative maintenance procedures, including normal and emergency procedures.
- B. Submit final copies of As-Built Drawings and Operating and Maintenance Manuals to Owner at seminar.

3.23 OPERATING AND MAINTENANCE MANUALS

- A. Provide Operating and Maintenance Manuals for equipment and materials furnished under this Division.
- B. Submit three final copies of Operating and Maintenance Manuals for review at least ten weeks before the completion date. Assemble data in a completely indexed volume or volumes in three-ring binders and identify the size, model, and features indicated for each item. Print the project name on the outside of the binders.
- C. Maintenance manuals shall include complete cleaning and servicing data compiled in a clear and easily understandable format. Show model numbers of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.
- D. Provide the following information where applicable:
 - 1. Identifying name and mark number.
 - 2. Locations (where several similar items are used, provide a list).
 - 3. Complete nameplate data.
 - 4. Certified As-Built Drawings and Final Reviewed submittals.
 - 5. Parts list.
 - 6. Performance curves and data.
 - 7. Wiring diagrams.
 - 8. Manufacturer's recommended operating and maintenance instructions with all non-applicable information deleted.
 - 9. List of spare parts recommended for normal service requirements.
 - 10. Assembly and disassembly instructions with exploded view drawings where necessary.
 - 11. Test reports.
 - 12. Trouble shooting diagnostic instructions where applicable.

3.24 AS-BUILT DRAWINGS

- A. The Contractor shall maintain on a daily basis at the Project site a complete set of As-Built drawings. The As-Built drawings shall initially consist of a set of prints or AutoCAD files of the Contractor's Coordination Drawings. The prints shall be marked or the AutoCAD files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded conduit, raceways and boxes, and all changes and deviations in the Electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Architect or Engineer. The updated As-Built drawings shall be used to produce the final As-Built drawings that shall be delivered to the Owner in AutoCAD electronic format media upon Project completion.

- B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two dimensions to permanent structures.
- C. The Contractor and Subcontractor shall mark all in-progress As-Built drawings on the front lower right hand corner with a rubber stamp impression or an AutoCAD image similar to the following:

As-Built DRAWING
(3/8 inch high letters)

To be used for recording Field Deviations and Dimensional Data Only
(5/16 inch high letters)

- D. Upon completion of the work, the Contractor and subcontractors shall certify all As-Built drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD image similar to the following:

AS-BUILT DRAWING
CERTIFIED CORRECT
(3/8 inch high letters)
(Printed Name of General Contractor)
(5/16 inch high letters)
Date:

(Printed Name of Subcontractor)
(5/16 inch high letters)
Date:

- E. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified As-Built drawings to the Architect and Engineer for review and shall make changes, corrections, or additions as the Architect and/or Engineer may require to the As-Built drawings. After the Architect's and Engineer's review, and any required Contractor revisions, the As-Built drawings shall be delivered to the Owner on electronic media in AutoCAD format. The Architect and Engineer do not assume any responsibility for the accuracy or completeness of the As-Built drawings.

3.25 FINAL PUNCHLIST

- A. Prior to the Final Punchlist, certify that systems and equipment are complete, operational, and are in compliance with the Contract Documents.
- B. During the Final Punchlist, provide personnel with access keys, hand held radios, and necessary expertise to operate each system and piece of equipment to demonstrate operational compliance with the Contract Documents.
- C. Any deficiencies noted on the Final Punchlist shall be expeditiously corrected and certified in writing.

END OF SECTION 260000

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SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Service entrance cable.
- D. Metal-clad cable.
- E. Wiring connectors.
- F. Electrical tape.
- G. Heat shrink tubing.
- H. Oxide inhibiting compound.
- I. Wire pulling lubricant.
- J. Cable ties.
- K. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers 2005 (Reapproved 2021).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation 2018.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- I. NECA 104 - Standard for Installing Aluminum Building Wire and Cable 2012.
- J. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable 2018.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- M. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- N. UL 267 - Outline of Investigation for Wire-Pulling Compounds Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- P. UL 854 - Service-Entrance Cables Current Edition, Including All Revisions.

Q. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
- D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Service entrance cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For underground service entrance, installed in raceway.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to damage.
- E. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires, or where used for final connection to equipment requiring flexibility.
 - 1) Maximum Length: 6 feet (1.8 m).
2. In addition to other applicable restrictions, may not be used:
 - a. Where not approved for use by the authority having jurisdiction.
 - b. Where exposed to view, except in dedicated electrical, communications, and mechanical rooms where not subject to damage.
 - c. Where exposed to damage.
 - d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
 - e. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 260526.
- H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- I. Conductor Material:
 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
 - 1) Services: Copper conductors size 1/0 AWG and larger.
 - 2) Feeders: Copper conductors size 1/0 AWG and larger.
 - 3) Dedicated large equipment circuits: Copper conductors size #4 AWG and larger.
 - b. Where aluminum conductors are substituted for copper, comply with the following:
 - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
 - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
 - 3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
 - 4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 3. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- J. Minimum Conductor Size:
 1. Branch Circuits: 12 AWG.
 - a. Exceptions:

- 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
- 2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
2. Control Circuits: 14 AWG.
- K. Conductor Color Coding:
 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.
 - c. Isolated Ground, All Systems: Green with yellow stripe.
 - d. Travelers for 3-Way and 4-Way Switching: Pink.
 - e. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
 - c. Service Wire Co: www.servicewire.com/#sle.
 - d. Southwire Company: www.southwire.com/#sle.
 2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
 - a. Southwire Company: www.southwire.com/#sle.
 - b. Stabiloy, a brand of General Cable Technologies Corporation; _____: www.stabiloy.com/#sle.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Stranded.
 - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 SERVICE ENTRANCE CABLE

- A. Manufacturers:
 1. Aluminum Service Entrance Cable:
 - a. Encore Wire Corporation: www.encorewire.com/#sle.
 - b. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
 - c. Southwire Company: www.southwire.com/#sle.
- B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.

2.05 METAL-CLAD CABLE

- A. Manufacturers:
 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 2. Encore Wire Corporation: www.encorewire.com/#sle.

- 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Grounding: Full-size integral equipment grounding conductor.
- G. Armor: Aluminum or steel, interlocked tape.
- H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.06 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 260526.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors, push-in wire connectors, or mechanical connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 4. Aluminum Conductors: Use compression connectors for all connections.
 - 5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - 6. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 - 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
- G. Push-in Wire Connectors: Rated 600 V, 221 degrees F (105 degrees C).
- H. Mechanical Connectors: Provide bolted type or set-screw type.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.07 ACCESSORIES

- A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- D. Wire Pulling Lubricant:
1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. American Polywater Corporation: www.polywater.com/#sle.
 - c. Ideal Industries, Inc: www.idealindustries.com/#sle.
 2. Listed and labeled as complying with UL 267.
 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 4. Suitable for use at installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is permitted where not otherwise prohibited, except for the following:
 - a. Branch circuits fed from feed-through protection of GFI receptacles.
 - b. Branch circuits with dimming controls.
 - c. Branch circuits with isolated grounding conductor.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install metal-clad cable (Type MC) in accordance with NECA 120.
- F. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- I. Terminate cables using suitable fittings.
 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.

- 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 - 1. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
 - 2. Wet Locations: Use heat shrink tubing.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods approved by AHJ.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Ground plate electrodes.
- G. Ground access wells.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2022.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Rod Electrode(s):
 - a. Provide two electrodes unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
 - c. Provide ground access well for each electrode.
 - 6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
- E. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- F. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 - c. Generators, when neutral is switched in the transfer switch.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 - c. Metal process piping.
 8. Provide bonding for metal building frame.
 9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

H. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

I. Pole-Mounted Luminaires: Also comply with Section 265600.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use mechanical connectors for connections to electrodes at ground access wells.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Burndy LLC; _____: www.burndy.com/#sle.
 - b. Harger Lightning & Grounding; _____: www.harger.com/#sle.
 - c. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC; _____: www.burndy.com/#sle.
 - b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.
- D. Ground Bars:
 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 4. Manufacturers:
 - a. Harger Lightning & Grounding; _____: www.harger.com/#sle.
 - b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.
- E. Ground Rod Electrodes:
 1. Comply with NEMA GR 1.

2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 5/8 inch (16 mm) diameter by 8 feet (2.4 m) length, unless otherwise indicated.
 4. Manufacturers:
 - a. Galvan Industries, Inc; _____: www.galvanelectrical.com/#sle.
 - b. Harger Lightning & Grounding; _____: www.harger.com/#sle.
- F. Ground Plate Electrodes:
1. Material: Copper.
 2. Size: 24 by 24 by 1/4 inches (610 by 610 by 6 mm), unless otherwise indicated.
 3. Manufacturers:
 - a. Harger Lightning & Grounding; _____: www.harger.com/#sle.
 - b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.
- G. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
 - a. Round Wells: Not less than 8 inches (200 mm) in diameter.
 - b. Rectangular Wells: Not less than 12 by 12 inches (300 by 300 mm).
 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches (250 mm).
 4. Cover: Factory-identified by permanent means with word "GROUND".
 5. Manufacturers:
 - a. Harger Lightning & Grounding; _____: www.harger.com/#sle.
 - b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches (750 mm).
- E. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

- 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

- F. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 260526

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Liquidtight flexible metal conduit (LFMC).
- C. Galvanized steel electrical metallic tubing (EMT).
- D. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.
- E. Section 260533.23 - Surface Raceways for Electrical Systems.
- F. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- E. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- F. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- I. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- J. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.
- L. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- N. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.

5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.06 QUALITY ASSURANCE

- A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
 5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows for bends.
 6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
 7. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches (100 mm) on either side of where conduit emerges.
- D. Embedded Within Concrete:
1. Within Slab on Grade: Not permitted.
 2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.

4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from concrete.
5. Where aluminum rigid metal conduit (RMC) and aluminum electrical metallic tubing (EMT) is installed in concrete, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
- E. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- G. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
- H. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
- I. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC) or MC cable.
 1. Maximum Length: 6 feet (1.8 m).
- J. Flexible Connections to Vibrating Equipment:
 1. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 2. Interior Dry Locations: Use flexible metal conduit (FMC) or MC cable.
 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers and motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Electrical Service Conduits: See Section 262100 for additional requirements.
- C. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.
- D. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 1. Branch Circuits: 1/2-inch (16 mm) trade size.
 2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
 3. Control Circuits: 1/2-inch (16 mm) trade size.
 4. Flexible Connections to Luminaires: 3/8-inch (12 mm) trade size.
 5. Underground, Interior: 3/4-inch (21 mm) trade size.
 6. Underground, Exterior: 1-inch (27 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - 4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
 - 5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).
- E. Conduit Mechanical Seals:
 - 1. Listed as complying with UL 514B.
 - 2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 - 3. Suitable for sealing around conductors/cables to be installed.
- F. Sealing Systems for Concrete Penetrations:
 - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
 - 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- H. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- F. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 5. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 6. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 7. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 - 8. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
 - 9. Route conduits above water and drain piping where possible.

10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
 12. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
- G. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
- H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 7. Secure joints and connections to provide mechanical strength and electrical continuity.
- I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 7. Install firestopping to preserve fire resistance rating of partitions and other elements;.
- J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 2 inches (50.8 mm) on all sides unless otherwise indicated.
- K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- L. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

M. Provide grounding and bonding; see Section 260526.

3.03 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Correct deficiencies and replace damaged or defective conduits.

3.04 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

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SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Floor boxes.
- E. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- D. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.
 - 3. Additional requirements for locating boxes for wiring devices.
- E. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use suitable concrete type boxes where flush-mounted in concrete.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 12. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Communications Systems Outlets: Comply with Section 271000.
 - 13. Wall Plates: Comply with Section 262726.

14. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com/#sle.
 - c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
 - b. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Wiegmann Products; _____: www.hubbell-wiegmann.com/#sle.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
 1. Manufacturers:
 - a. Hubbell Incorporated; _____: www.hubbell.com/#sle.
- E. Floor Boxes:
 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- E. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- F. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 2. Unless dimensioned, box locations indicated are approximate.
 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
 - b. Communications Systems Outlets: Comply with Section 271000.
 4. Locate boxes so that wall plates do not span different building finishes.
 5. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
 6. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 7. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
 8. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- G. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- H. Install boxes plumb and level.
- I. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- J. Install boxes as required to preserve insulation integrity.
- K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 260526.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

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**SECTION 260923
LIGHTING CONTROL DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Time switches.
- D. Outdoor photo controls.
- E. Daylighting controls.
- F. Lighting contactors.
- G. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
 - 1. Includes finish requirements for wall controls specified in this section.
 - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
- E. Section 265100 - Interior Lighting.
- F. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols 2020.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
 - 4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Shop Drawings:
 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
 2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- D. Field Quality Control Reports.
- E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 260000 - GENERAL CONDITIONS , for additional warranty requirements.
- B. Provide five year manufacturer warranty for all occupancy sensors.
- C. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 2. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
 3. Acuity Brands Lighting, Inc.; [_____]: www.acuitybrands.com/#sle.
 4. Sensor Switch Inc; _____: www.sensorswitch.com/#sle.
- B. All Occupancy Sensors:
 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 2. Sensor Technology:
 - a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 7. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 8. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 9. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
 10. Wireless Sensors:
 - a. RF Range: 30 feet (9 m) through typical construction materials.
 - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
 - c. Power: Battery-operated with minimum ten-year battery life.
- C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - e. Provide selectable audible alert to notify occupant of impending load turn-off.
 - f. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
 2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
- D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
 - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
 - e. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.

2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
- E. Ceiling Mounted Occupancy Sensors:
 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
- F. Power Packs for Low Voltage Occupancy Sensors:
 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 4. Load Rating: As required to control the load indicated on drawings.
- G. Power Packs for Wireless Occupancy Sensors:
 1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
 2. Input Supply Voltage: Dual rated for 120/277 V ac.
 3. Load Rating: As required to control the load indicated on drawings.

2.03 OUTDOOR MOTION SENSORS

- A. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.
- B. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
- C. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.
- D. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.
- E. Integral Photocell: For dusk to dawn operation.
- F. Manual Override: Activated by switching power off to unit and then back on.
- G. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.
- H. Coverage: Capable of detecting motion within a distance of 50 feet (15 m) at a mounting height of 8 feet (2.4 m), with a field of view of 270 degrees.

2.04 TIME SWITCHES

- A. Digital Electronic Time Switches:
 1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
 2. Program Capability:
 - a. 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
 - b. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
 - c. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
 3. Schedule Capacity: Not less than 16 programmable on/off operations.

4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: Multiple voltage input for 120, 208, 240 or 277 V ac.
8. Output Switch Contact Ratings: As required to control the load indicated on drawings.
9. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 1.
 - b. Outdoor locations: Type 3R.

2.05 OUTDOOR PHOTO CONTROLS

- A. Stem-Mounted Outdoor Photo Controls:
 1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 2. Housing: Weatherproof, impact resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Provide external sliding shield for field adjustment of light level activation.
 5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 6. Voltage: As required to control the load indicated on the drawings.
 7. Failure Mode: Fails to the on position.
 8. Load Rating: As required to control the load indicated on the drawings.
 9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.
- B. Button Type Outdoor Photo Controls
 1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
 2. Housing: Weather resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.

2.06 DAYLIGHTING CONTROLS

- A. Manufacturers:
 1. Hubbell Control Solutions; _____:
www.hubbell.com/hubbellcontrolsolutions/en/#sle. Hubbell Control Solutions;
 _____: www.hubbell.com/hubbellcontrolsolutions/en/#sle. Hubbell Control Solutions;
 _____: www.hubbell.com/hubbellcontrolsolutions/en/#sle.
 2. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
 3. Sensor Switch Inc; _____: www.sensorswitch.com/#sle.
- B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
- C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
 1. Sensor Type: Filtered silicon photo diode.
 2. Sensor Range:
 - a. Indoor Photo Sensors: 5 to 100 footcandles (53.8 to 1,080 lx).
 - b. Outdoor Photo Sensors: 5 to 250 footcandles (53.8 to 2690 lx).

3. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
4. Wireless Daylighting Control Photo Sensors:
 - a. RF Range: 30 feet (9 m) through typical construction materials.
 - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
 - c. Power: Battery-operated with minimum ten-year battery life.
- D. Daylighting Control Switching Modules for Wireless Sensors:
 1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
 2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
 3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
 4. Control Capability: Capable of controlling one programmable channel.
 5. Input Supply Voltage: Dual rated for 120/277 V ac.
 6. Load Rating: As required to control the load indicated on drawings.
- E. Daylighting Control Dimming Modules for Wireless Sensors:
 1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.
 2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
 3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
 4. Control Capability: Capable of controlling up to 32 ballasts with up to two separately programmable daylighting zones.
- F. Power Packs for Low Voltage Daylighting Control Modules:
 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 2. Input Supply Voltage: Dual rated for 120/277 V ac.
 3. Load Ratings: As required to control the load indicated on drawings.

2.07 LIGHTING CONTACTORS

- A. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- B. Short Circuit Current Rating:
- C. Enclosures:
 1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 3. Finish: Manufacturer's standard unless otherwise indicated.

2.08 ACCESSORIES

- A. Auxiliary Contacts:
 1. Comply with NEMA ICS 5.
 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

- B. Pilot Devices:
 - 1. Comply with NEMA ICS 5; heavy-duty type.
 - 2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 - 3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 - 4. Indicating Lights: Push-to-test type unless otherwise indicated.
 - 5. Provide LED lamp source for indicating lights and illuminated devices.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switch Occupancy Sensors: 48 inches (1.2 m) above finished floor.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.
- G. Provide required supports in accordance with Section 260529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Occupancy Sensor Locations:
 - 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- J. Outdoor Photo Control Locations:
1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- L. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
 2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
 3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
- M. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

- A. Inspect each lighting control device for damage and defects.
- B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- C. Test time switches to verify proper operation.
- D. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- E. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
- F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.
- G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 260923

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SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 262413 - Switchboards: Service entrance equipment.
- G. Section 262416 - Panelboards: Service entrance equipment.
- H. Section 262816.16 - Enclosed Switches: Service entrance equipment.
- I. Section 263213 - Engine Generators: Emergency/standby power systems for interconnection with normal utility electrical supply.
- J. Section 263600 - Transfer Switches: Service entrance equipment.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Allowances:
 - 1. Include cash allowance for Utility Company charges associated with providing service.

1.04 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.05 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.06 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
 - 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
 - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Owner.
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.
- F. Scheduling:
 - 1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
 - 2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.07 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. IEEE C2 (National Electrical Safety Code).
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Utility Company: To be determined by Contractor.
- D. Division of Responsibility: Per Utility Company requirements.
- E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment components in accordance with Section 260529.
- E. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.
- F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

END OF SECTION 262100

SECTION 262413 SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262100 - Low-Voltage Electrical Service Entrance.
- D. Section 262300 - Low-Voltage Switchgear.
- E. Section 262713 - Electricity Metering: For interface with equipment specified in this section.
- F. Section 262813 - Fuses: Fuses for fusible switches.
- G. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- E. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- F. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- J. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- K. UL 891 - Switchboards Current Edition, Including All Revisions.
- L. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

- B. Service Entrance Switchboards:
 - 1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 - 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 - 3. Obtain Utility Company approval of switchboard prior to fabrication.
 - 4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 - 4. Include documentation demonstrating selective coordination upon request.
 - 5. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Enclosure Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Switchboards - Basis of Design: Eaton Corporation.
- B. Switchboards - Other Acceptable Manufacturers:
 - 1. ABB/GE; _____: www.electrification.us.abb.com/#sle.
 - 2. Eaton Corporation; _____: www.eaton.com/#sle.
 - 3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - 4. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
 - 1. Main Device(s): Individually-mounted.
 - 2. Feeder Devices: Panel/group-mounted.
 - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 - 4. Gutter Access: Bolted covers.
- E. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 - 3. Comply with Utility Company requirements for electrical service.
 - 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
 - 5. See Section 262100 for additional requirements.
- F. Service Conditions:
 - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature:
 - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- G. Short Circuit Current Rating:
 - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

- I. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- J. Bussing: Sized in accordance with UL 891 temperature rise requirements.
 - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 - 2. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 3. Phase and Neutral Bus Material: Aluminum.
 - 4. Ground Bus Material: Aluminum.
- K. Conductor Terminations: Suitable for use with the conductors to be installed.
 - 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 - 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
- L. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
- M. Future Provisions:
 - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - 2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
- N. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.
- O. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- P. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- Q. Owner Metering: Comply with Section 262713.
- R. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide electronic trip circuit breakers where indicated.
 - b. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - 2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
 - c. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch (10 mm) between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch (100 mm) high concrete pad.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as indicated.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.

3.03 FIELD QUALITY CONTROL

- A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.1.
- E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- F. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- G. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- H. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION 262413

SECTION 262416 PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- D. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- N. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.
- O. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE; _____: www.electrification.us.abb.com/#sle.
- B. Eaton Corporation; _____: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 22,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
8. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Install all field-installed branch devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- L. Set field-adjustable circuit breaker tripping function settings as indicated.
- M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- N. Provide filler plates to cover unused spaces in panelboards.
- O. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 1. Emergency and night lighting circuits.
 2. Fire detection and alarm circuits.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- C. Test GFCI circuit breakers to verify proper operation.
- D. Test shunt trips to verify proper operation.
- E. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

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SECTION 262726 WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.
- F. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- E. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 - 6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittal procedures.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- F. Isolated Ground Convenience Receptacles: Orange.
- G. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.
- H. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.

2.03 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- D. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

- E. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

- A. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
 - 2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with separate on/off switch.
- D. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.05 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
 - 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
 - 3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 - 4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
 - 5. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
 5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
- E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.

2.06 WALL PLATES

- A. Manufacturers:
1. Hubbell Incorporated; _____: www.hubbell-wiring.com/#sle.
 2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
 3. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
 4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard; _____.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 2. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
 3. Wiremold, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- B. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.
- C. Flush Floor Service Fittings:
1. Dual Service Flush Combination Outlets:
 - a. Cover: Rectangular.
 - b. Configuration:
 - 1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
 - 2) Communications: _____.
 - 3) Voice and Data Jacks: Provided by others.
 2. Dual Service Flush Furniture Feed:
 - a. Cover: Rectangular.
 - b. Configuration:
 - 1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
 - 2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
 3. Accessories:
 - a. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

4. Products:
 - a. Hubbell Incorporated; _____: www.hubbell.com/#sle.

2.08 POKE-THROUGH ASSEMBLIES

- A. Manufacturers:
 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 2. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
 3. Wiremold, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches (1200 mm) above finished floor.
 - b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
 - c. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 3. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.03 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.04 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

SECTION 262813 FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 262413 - Switchboards: Fusible switches.
- B. Section 262416 - Panelboards: Fusible switches.
- C. Section 262816.16 - Enclosed Switches: Fusible switches.
- D. Section 262913 - Enclosed Controllers: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- D. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.
- E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
- B. Littelfuse, Inc; _____: www.littelfuse.com/#sle.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Class L Fuses: Comply with UL 248-10.
- I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

SECTION 262816.16 ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262813 - Fuses.
- D. Section 262913 - Enclosed Controllers: Manual motor controllers.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE; _____: www.electrification.us.abb.com/#sle.
- B. Eaton Corporation; _____: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
 - 2. Minimum Ratings:
 - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
 - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

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**SECTION 262913
ENCLOSED CONTROLLERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
 - 1. Magnetic motor starters.
 - 2. General purpose contactors.
 - 3. Manual motor starters.
 - 4. Motor-starting switches without overload protection.
- B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262813 - Fuses: Fuses for fusible switches.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- D. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.
- E. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- F. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
 - 3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
 - 4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE; _____: www.electrification.us.abb.com/#sle.
- B. Eaton Corporation; _____: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.

2.02 ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
 - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:
 - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
 - 2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- E. Short Circuit Current Rating:
 - 1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures:
 - 1. Comply with NEMA ICS 6.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- I. Instrument Transformers:
 - 1. Comply with IEEE C57.13.

2. Select suitable ratio, burden, and accuracy as required for connected devices.
 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- J. Magnetic Motor Starters: Combination type unless otherwise indicated.
1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
 2. Configuration: Full-voltage non-reversing unless otherwise indicated.
 3. Disconnects: Circuit breaker type.
 - a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
 - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
 4. Overload Relays: Bimetallic thermal type unless otherwise indicated.
- K. General Purpose Contactors: Combination type unless otherwise indicated.
1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
 2. Configuration: Full-voltage non-reversing unless otherwise indicated.
 3. Disconnects: Circuit breaker type.
 - a. Circuit Breakers: Thermal magnetic unless otherwise indicated or required.
 - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
- L. Manual Motor Starters:
1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
 2. Configuration: Non-reversing unless otherwise indicated.
 3. Fractional-Horsepower Manual Motor Starters:
 - a. Furnish with toggle operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
 4. Integral-Horsepower Manual Motor Starters:
 - a. Furnish with toggle or pushbutton operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
- M. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 3. Trip-free operation.
 4. Visible trip indication.
 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.
 6. Bimetallic Thermal Overload Relays:

- a. Interchangeable current elements/heaters.
 - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - c. Trip test function.
- 7. Melting Alloy Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
- B. Circuit Breakers:
 - 1. Interrupting Capacity (not applicable to motor circuit protectors):
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Motor Circuit Protectors:
 - a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
 - b. Provide field-adjustable magnetic instantaneous trip setting.
 - 3. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

2.04 CONTROL ACCESSORIES

- A. Auxiliary Contacts:
 - 1. Comply with NEMA ICS 5.
 - 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.
- B. Pilot Devices:
 - 1. Comply with NEMA ICS 5; heavy-duty type.
 - 2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 - 3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 - 4. Indicating Lights: Push-to-test type unless otherwise indicated.
 - 5. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
 - 1. Comply with NEMA ICS 5.
 - 2. Provide number and type of relays indicated or required to perform necessary functions.
- D. Control Power Transformers:
 - 1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus _____ VA spare capacity.
 - 2. Include primary and secondary fuses.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

- B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 260526.
- G. Install all field-installed devices, components, and accessories.
- H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- I. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- D. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 PROTECTION

- A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION 262913

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SECTION 263213 ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories:
 - 1. Engine and engine accessory equipment.
 - 2. Generator set enclosure.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 263600 - Transfer Switches.

1.03 REFERENCE STANDARDS

- A. ASTM D975 - Standard Specification for Diesel Fuel 2022a.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA/EGSA 404 - Standard for Installing Generator Sets 2014.
- D. NEMA MG 1 - Motors and Generators 2021.
- E. NFPA 30 - Flammable and Combustible Liquids Code 2021, with Amendment.
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 99 - Health Care Facilities Code 2021, with Amendment.
- I. NFPA 110 - Standard for Emergency and Standby Power Systems 2022.
- J. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids Current Edition, Including All Revisions.
- K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries Current Edition, Including All Revisions.
- L. UL 2200 - Stationary Engine Generator Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.

1. Include characteristic trip curves for overcurrent protective devices upon request.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- E. Manufacturer's factory emissions certification.
- F. Maintenance contracts.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 1. NFPA 70 (National Electrical Code).
 2. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
 3. NFPA 30 (Flammable and Combustible Liquids Code).
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 260000 - GENERAL CONDITIONS , for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Packaged Engine Generator Set - Other Acceptable Manufacturers:
 1. MTU Onsite Energy, a Brand of Rolls-Royce Power Systems; _____:
www.mtuonsiteenergy.com/#sle.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system as shown in plans consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:

1. Application: Emergency/standby.
 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
- D. Packaged Engine Generator Set:
1. Type: Diesel and Gaseous in different locations per plans..
 2. Power Rating: See plans for sizing. kW, standby.
 3. Voltage: As indicated on drawings.
- E. Generator Set General Requirements:
1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 2. Factory-assembled, with components mounted on suitable base.
 3. List and label engine generator assembly as complying with UL 2200.
 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- G. Starting and Load Acceptance Requirements:
1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- H. Exhaust Emissions Requirements:
1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Diesel (Compression Ignition):
1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
 2. Fuel Storage: Sub-base fuel tank.
 3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
 4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 5. Sub-Base Fuel Tank:
 - a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
 - b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
 - c. Features:
 - 1) Direct reading fuel level gauge.

- 2) Normal atmospheric vent.
 - 3) Emergency pressure relief vent.
 - 4) Fuel fill opening with lockable cap.
 - 5) Dedicated electrical conduit stub-up area.
- C. Engine Fuel System - Gaseous (Spark Ignition):
1. Fuel Source: Natural gas.
 2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
 - a. Carburetor.
 - b. Gas pressure regulators.
 - c. Fuel shutoff control valves.
 - d. Low gas pressure switches.
- D. Engine Starting System:
1. System Type: Electric, with DC solenoid-activated starting motor(s).
 2. Battery(s):
 - a. Battery Type: Lead-acid.
 - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
 - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
 4. Battery Charger:
 - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
- E. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- F. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- G. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
- H. Engine Air Intake and Exhaust System:

1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

2.04 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
 1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 4. Generator Set Protection and Warning/Shutdown Indications:

- a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
- b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
- c. Provide contacts for local and remote common alarm.
- d. Provide lamp test function that illuminates all indicator lamps.
- 5. Other Control Panel Features:
 - a. Event log.

2.06 GENERATOR SET ENCLOSURE

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.
- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.
- H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch (150 mm) high concrete pad.
- F. Provide required support and attachment in accordance with Section 260529.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide diesel fuel piping and venting in accordance with Section 231113, where not factory installed.
- I. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.
 - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 - 2. Do not exceed manufacturer's maximum back pressure requirements.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- D. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.
 - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
 - 3. Check for proper oil and coolant levels.
- E. Prepare and start system in accordance with manufacturer's instructions.
- F. Provide field emissions testing where necessary for certification.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Manufacturer's authorized representative.

3.06 PROTECTION

- A. Protect installed engine generator system from subsequent construction operations.

3.07 MAINTENANCE

- A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.
- B. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION 263213

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SECTION 263600 TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.
 - 2. Manual transfer switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 262816.16 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.
- E. Section 263213 - Engine Generators: For interface with transfer switches.
 - 1. Includes code requirements applicable to work of this section.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment 2020.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems 2022.
- G. UL 1008 - Transfer Switch Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - a. Engine Generators: See Section 263213.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
 - 1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
 - 1. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source quality control test reports.
- F. Maintenance contracts.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
 - 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 263213.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity; manufacturer's authorized installer.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 260000 - GENERAL CONDITIONS , for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transfer Switches:
 - 1. ABB/GE; _____: www.electrification.us.abb.com/#sle.
 - 2. Eaton Corporation: www.eaton.com/#sle.
 - 3. Same as manufacturer of engine generator(s) used for this project.

2.02 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.

- C. Applications:
 - 1. Utilize open transition transfer unless otherwise indicated or required.
 - 2. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
 - a. Unless otherwise indicated or required, provide solid (unswitched) neutral.
 - 3. Provide signal before transfer contacts for transfer switches serving elevators.
- D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- E. Automatic Transfer Switch:
 - 1. Transfer Switch Type: As indicated on the drawings.
 - 2. Transition Configuration: As indicated on the drawings.
 - 3. Voltage: As indicated on the drawings.
 - 4. Ampere Rating: As indicated on the drawings.
 - 5. Neutral Configuration: Solid neutral (unswitched), except as indicated.
 - 6. Load Served: As indicated on the drawings.
 - 7. Primary Source: As indicated on the drawings.
 - 8. Alternate Source: As indicated on the drawings.
- F. Manual Transfer Switch:
 - 1. Voltage: As indicated on the drawings.
 - 2. Ampere Rating: As indicated on the drawings.
 - 3. Neutral Configuration: Solid neutral (unswitched), except as indicated.
 - 4. Load Served: As indicated on the drawings.
 - 5. Primary Source: As indicated on the drawings.
 - 6. Alternate Source: As indicated on the drawings.
- G. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- H. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- I. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- J. Switching Methods:
 - 1. Open Transition:
 - a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
 - 2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- K. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
- L. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
- M. Short Circuit Current Rating:
 - 1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as indicated on the drawings.
- N. Automatic Transfer Switches:
 - 1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.

2. Control Functions:
 - a. Automatic mode.
 - b. Test Mode: Simulates failure of primary/normal source.
 - c. Voltage and Frequency Sensing:
 - 1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
 - 2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - 3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - d. Outputs:
 - 1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
 - 2) Auxiliary contacts; one set(s) for each switch position.
 - e. Adjustable Time Delays:
 - 1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
 - 2) Transfer to alternate/emergency source time delay.
 - 3) Retransfer to primary/normal source time delay.
 - 4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
 - f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.
 - g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
3. Status Indications:
 - a. Connected to alternate/emergency source.
 - b. Connected to primary/normal source.
 - c. Alternate/emergency source available.
4. Automatic Sequence of Operations:
 - a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
 - b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
 - c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
 - d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.
- O. Manual Transfer Switches:
 1. Description: Transfer switches with manually initiated transfer between sources; mechanically operated and mechanically held.
- P. Interface with Other Work:
 1. Interface with engine generators as specified in Section 263213.

2.03 SOURCE QUALITY CONTROL

- A. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

- B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch (80 mm) high concrete pad.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Automatic Transfer Switches:
 - 1. Inspect and test in accordance with NETA ATS, except Section 4.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.
- C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Manufacturer's authorized representative.

3.06 PROTECTION

- A. Protect installed transfer switches from subsequent construction operations.

3.07 MAINTENANCE

- A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION 263600

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**SECTION 265100
INTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.16 - Boxes for Electrical Systems.
- C. Section 260923 - Lighting Control Devices.
- D. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.
- E. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.
- E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
- F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- J. UL 1598 - Luminaires Current Edition, Including All Revisions.
- K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
 - 2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
 - 3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 260000 - GENERAL CONDITIONS , for additional warranty requirements.
- B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Manufacturers:
 - 1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
 - 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
 - 3. Hubbell Lighting, Inc; _____: www.hubbellighting.com/#sle.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.

- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
 - 1. Acuity Brands, Inc; _____: www.acuitybrands.com/#sle.
 - 2. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com/#sle.
 - 3. Hubbell Lighting, Inc; _____: www.hubbelllighting.com/#sle.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
 - 1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
 - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Accessories:
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2.04 EXIT SIGNS

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 - 2. Directional Arrows: As indicated or as required for installed location.
- B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
 - 1. Manufacturers:
 - a. Acuity Brands, Inc; _____: www.acuitybrands.com/#sle.

- b. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com/#sle.
- c. Hubbell Lighting, Inc; _____: www.hubbellighting.com/#sle.
- 2. Self-Powered Exit Signs:
 - a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
 - c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
 - e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
- H. Suspended Luminaires:
 - 1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
- I. Install accessories furnished with each luminaire.

- J. Bond products and metal accessories to branch circuit equipment grounding conductor.
- K. Emergency Lighting Units:
- L. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- M. Install lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.04 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.05 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

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SECTION 265600 EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts.
- C. Lamps.
- D. Poles and accessories.
- E. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260923 - Lighting Control Devices.
 - 1. Includes automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
- E. Section 262726 - Wiring Devices: Receptacles for installation in poles.
- F. Section 262813 - Fuses.
- G. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 2013, with Editorial Revision (2022).
- B. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.
- C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- E. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities 2021.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- G. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 1598 - Luminaires Current Edition, Including All Revisions.
- K. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits Current Edition, Including All Revisions.
- L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 260000 - GENERAL CONDITIONS , for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
 - 2. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

- A. See Section 260000 - GENERAL CONDITIONS , for additional warranty requirements.
- B. Provide 5-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Manufacturers:
 - 1. Acuity Brands, Inc; _____: www.acuitybrands.com/#sle.
 - 2. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com/#sle.
 - 3. Hubbell Lighting, Inc; _____: www.hubbelllighting.com/#sle.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 POLES

- A. All Poles:
 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 2. Structural Design Criteria:
 - a. Comply with AASHTO LTS.
 - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 3. Material: Steel, unless otherwise indicated.
 4. Shape: Square straight, unless otherwise indicated.
 5. Finish: Match luminaire finish, unless otherwise indicated.
 6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.

2.04 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Pole-Mounted Luminaires:
 1. Maintain the following minimum clearances:
 - a. Comply with IEEE C2.
 - b. Comply with utility company requirements.
 2. Foundation-Mounted Poles:
 - a. Install foundations plumb.
 - b. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
 - c. Tighten anchor bolt nuts to manufacturer's recommended torque.

- 3. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
- 4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
- G. Install accessories furnished with each luminaire.
- H. Bond products and metal accessories to branch circuit equipment grounding conductor.
- I. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600

SECTION 27 0500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor for the installation of an inside plant telecommunication system. All materials shall be new, free from defects, of current manufacture, and of the quality specified or shown. Each type of material shall be of the same manufacture throughout the work. This section includes Inside Plant Communications cabling, termination, and administration equipment and installation requirements for the specified Structured Cabling System (SCS).

1.2 SYSTEM DESCRIPTION

- A. Provide complete with all accessories, a Gigabit Passive Optical Network (GPON) system for distribution of fiber optic data signals throughout the facility as indicated on the drawings.
- B. The Gigabit Passive Optical Network system shall serve as a vehicle for transmission of data and voice telephony signals from designated Optical Line Terminals to Optical Network Terminals shown in various locations as indicated on the drawings. Applications standards supported should include, but be not limited to, IEEE 802.3, 10GBASE-T, 1000BASE-T, ATM and evolving high-end applications.
- C. The system shall include Optical Line Terminals, Optical Network Terminals, fiber optic splitters, fiber optic patch panels, backbone cable, horizontal station cable, innerduct, terminations and accessories as required for a complete and functional system.
- D. The Contractor shall identify all cables and terminals in accordance with the Owner's direction.
- E. The Contractor shall test the system to assure that it complies with the requirements of FDDI Standards.
- F. The electronic equipment designed for office environments, equipment rooms and telecommunications closets shall be rated for continuous operation under ambient environment conditions of 50 degrees F, to 85 degrees F and 35% to 65% relative humidity, non-condensing.

1.3 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 and to all Division 27 Specification Sections.

1.4 STANDARDS AND CODES

- A. Incorporate by reference the latest updates of the applicable portions of the following specifications, standards, codes into this specification section.

1. General:
 - a. National Fire Protection Association (NFPA) – NFPA 70: National Electrical Code (NEC)
 - b. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.
 - c. National Fire Protection Association (NFPA) – NFPA 780: Standard for the Installation of Lightning Protection Systems
 - d. National Fire Protection Association (NFPA) – NFPA 75: Standard for the Fire Protection of Information Technology Equipment
 - e. National Electrical Safety Code (NESC)
 - f. Occupational Safety and Health Act (OSHA)
 - g. Washington Industrial Safety and Health Act (WISHA)
 - h. Washington State Rules and Regulations for Installing Electrical Wires and Equipment (RCW 19.28, WAC 296-46 and WAC 296-401A)
 - i. Washington State Department of Labor and Industries Safety Standards for General Safety and Health (WAC 296-24 Volume 1 Part L)
2. Communications:
 - a. ANSI/TIA - 455: Fiber Optic Test Standards
 - b. ANSI/TIA - 526: Optical Fiber Systems Test Procedures
 - c. ANSI/TIA - 568-C.0: Generic Telecommunications Cabling for Customer Premises
 - d. ANSI/TIA - 568-C.1: Commercial Building Telecommunications Cabling Standard
 - e. ANSI/TIA – 569-B: Commercial Building Standard for Telecommunication Pathways and Spaces
 - f. ANSI/TIA – 606-A: The Administration Standard for Commercial Telecommunications Infrastructure
 - g. ANSI/TIA – 607-B: Commercial Grounding (Earthing) and Bonding for Customer Premises
 - h. ANSI/TIA – 862: Building Automation Systems Cabling Standard for Commercial Buildings
 - i. ANSI/TIA/EIA 942 – Telecommunications Infrastructure Standard For Data Centers
 - j. ANSI/TIA -TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
 - k. ANSI/TIA -TSB75: Additional Horizontal Cabling Practices for Open Offices
 - l. ANSI/TIA/EIA 758 series – Customer-Owned Outside Plant Telecommunications Cabling Standard
 - m. NECA/FOA 301-1997: Standard for Installing and Testing Fiber Optic Cables
 - n. NECA/BICSI 568-2001: Standard for Installing Commercial Building Telecommunications Systems
 - o. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard
 - p. ISO/IEC IS 11801: Generic Cabling for Customer Premises
 - q. BICSI: BICSI Telecommunications Cabling Installation Manual
 - r. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)
 - s. BICSI: BICSI Outside Plant Design Reference Manual (OSPDRM)
 - t. BICSI: BICSI Network Design Reference Manual (NDRM)
3. Firestopping:

- a. Firestop Contractors International Association (FCIA), Manual of Practice
- b. ASTM E 84, "Surface Burning Characteristics of Building Materials".
- c. ASTM E 119, "Fire Tests of Building Construction and Materials".
- d. ASTM E 814, "Fire Tests of Through Penetration Firestops".
- e. ANSI/UL263, "Fire Tests of Building Construction and Materials".
- f. ANSI/UL723, "Surface Burning Characteristics of Building Materials".
- g. ANSI/UL1479, "Fire Tests of Through Penetration Firestops".
- h. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

- B. In case of differences between building codes, state laws, local ordinances, utility company regulations, and the Contract Documents, the most stringent shall govern; this shall not be construed as relieving the contractor from complying with any requirements of the plans or specifications which may be in excess of code requirements and not contrary to same.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

- A. The entire installation shall comply with the code requirements of all authorities having jurisdiction.
- B. Contractor shall arrange for all inspections and shall correct non-complying installations.

1.6 PERMITS AND FEES

- A. The Contractor, at their expense, shall obtain permits and inspections required for the electrical work on this project. Inspection certificates shall be included in the Operation and Maintenance Manuals. Deliver copies thereof to the Architect/Engineer prior to final acceptance of the work.

1.7 SUBMITTALS FOR REVIEW

- A. Submittals shall consist of neatly bound copies of catalog cuts, data sheets, manufacturer's installation recommendations, and other descriptive information for all specified materials.
- B. Provide submittals regarding qualifications as noted elsewhere in this section.
- C. Shop drawings shall include dimensioned layout of equipment rooms and telecommunications closets, including backboards, patch panels, telecommunications grounding bus bars, ladder racking, equipment, etc. Layouts shall show lighting fixtures, HVAC equipment, etc., which affect room layouts.
- D. Shop drawings shall include dimensioned layout of major pathways, including cable trays, sleeves and conduits, and dimensioned layouts of all conduits routed to the MDF or IDF for each outlet.
- E. Work under this section has been indicated on the drawings in locations which should allow installation without interfering with the work of other trades; however, exact finish locations cannot be indicated. Therefore, locations of all work and equipment shall be verified to avoid interferences, preserve head room and keep openings and passageways clear. The specialty Subcontractor shall review the plans for the work of the other trades and shall coordinate adjustment of their work, the work of the other trade or both to achieve the best installation for

the Owner without additional claims or charges. Shop drawings shall reflect coordination of work under this Section with the work of other trades.

1.8 CONTRACTOR QUALIFICATIONS

A. Qualifications:

1. Contractor shall be trained and certified by the Manufacturers to install, test, and maintain the SCS, and shall be certified by the SCS Manufacturers to provide the SCS Manufacturers' Warranties (see PART 1.5 C - WARRANTY). Provide documentation from the SCS manufacturers demonstrating that the Contractor is trained and certified by the following:
 - a. Tellabs Certification (for GPON). Contractor shall maintain these certifications throughout the duration of the project.
2. Contractor's employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS' manufacturers. Training and certifications by employee type are required as shown below. Provide documentation indicating that the Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below. Provide a list of the personnel who will be assigned to the project, the type of work they will be performing, and copies of the manufacturers' training certifications for each. If personnel changes are made during the project, submit the above information for any new personnel prior to their commencement of work on the project. Except where specified otherwise, the following training and certification requirements shall be met by the Contractor at the time of bidding:
 - a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing.
 - b. Test Technicians: All (100%) shall be trained/certified for installation and testing.
 - c. Installation Technicians: Prior to bidding, half (50%) shall be trained/certified for installation. Upon award of the project, the remaining untrained installation technicians shall be trained and certified by the manufacturer at no cost to the Owner.
 - d. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer-trained and certified. Otherwise, personnel not manufacturer-trained and certified shall not be allowed on the job site.
3. Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). Contractor shall continue to employ a minimum of one RCDD throughout the duration of the project.
 - a. Provide documentation demonstrating compliance with this requirement.

- B. Personnel who have not completed the requisite training shall not be employed by the Installer for cable termination, inspection, or testing purposes. Such personnel may assist in installation

of terminal boards, equipment racks, raceways, cable and the like (exclusive of termination and testing), if working under the direct supervision of trained personnel.

- C. The contractor is responsible for inclusion of a Tellabs certified Integrator. The Integrator shall be selected with pre-approval from the Skagit PUD IT staff. The Integrator shall provide services including but not limited to training, startup and GPON integration into the owner's current network. Any service contract agreed upon by the Owner and the Integrator shall be transferable to the owner. The integrator shall meet the following criteria.
1. Integrator shall have a physical office in Washington State. Provide address and number of employees located there.
 2. Integrator shall demonstrate experience integrating GPON technology in similar projects. Describe project and provide customer contact information.
 3. Integrator must be a certified Tellabs Integrator. Provide letter from Tellabs confirming.
 4. Integrator must be a Platinum or higher member of the Association of Passive Optical LAN.
 5. Provide biography of the proposed lead engineer showing relevant GPON experience on three projects of same size or larger.
 6. Provide resume of the proposed Project Manager demonstrating experience as Project Manager on three GPON projects of the same size or larger.
 7. Pre-approved GPON Integrators include:
 - a. AECOM (Chris Brown 509-201-0525)

1.9 COORDINATION

- A. References to the "Owner" or "Owner's representative" throughout the Division 27 specification sections shall be interpreted to mean both the Skagit PUD construction manager and Skagit PUD IT staff. All requirements to seek approval of the Owner require the involvement of the Skagit PUD IT staff.
- B. The Division 27 Contractor shall coordinate work with that of the other contractors doing work in the building and shall examine all drawings, including the several divisions of mechanical, ventilating, structural and general, for construction details and necessary coordination.
- C. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- D. Coordinate the interruption of electrical systems to any part of the facility in use by the Owner at least 48 hours before interruption of the system.
- E. Special attention is called for the following items and all conflicts shall be reported to the Architect/Engineer before installation for decision or correction:
1. Location of fixtures, pipes, ducts and other mechanical equipment such that telecommunications and audio/visual outlets, wall-mounted telephone devices, equipment racks and panels and other electrical equipment are mounted in proper relationship to these items.
 2. Location of cabinets and counters such that communications work is clear from and in proper relation to these items.

3. Penetrations of building structure for communications work.
 4. Compliance to Section 110-26 of NEC.
 5. Coordination and provisions for maintaining telephone service to areas in use during construction, especially elevator equipment, fire alarm systems, security systems and emergency systems (comply with General Division Provisions).
 6. Communications equipment shall fit in the space provided on the plan drawings or as specified. Equipment heights shall not exceed those shown or specified. Larger equipment shall not be considered acceptable. Contractor shall be responsible for all clearances around the communications equipment.
- F. Telephone and Internet services required by the Contractor during construction shall be provided by the Contractor. The Owner does not provide any communications utility services for construction projects. At substantial completion, the Owner will assume responsibility for communications utility services to the building and will transfer services at that time. This includes (but is not limited to) the following:
1. Telephone and Internet service for the Jobsite Construction Trailers
 2. Elevator telephone
 3. HVAC system Internet or networking
 4. Internet or networking for other building services.
- G. When conduit, insert or sleeves for outlet boxes and/or conduits are required, Contractor shall fully coordinate the installation thereof with other trades.
- H. Contractor shall coordinate the Division 27 work in other campus buildings that may be required to support the project, such as the Main Communications Facility (MCF), Intermediate Distribution Facilities (IDF), tunnels, vaults, enclosures, etc.
- I. The communications contractor shall take full responsibility for furnishing, installing and troubleshooting all communications systems in the building. The communications contractor shall be responsible for overall coordination of all communications systems and ensuring correct and full operation of all systems and system interfaces. The communications contractor shall coordinate the interfaces between the communications systems and all other systems.
- 1.10 SEQUENCING
- A. Provide coordination with the cabling manufacturers to ensure that manufacturers' inspectors are available to schedule site visits, inspections, and certification of the system. Provide and coordinate any manufacturer-required modifications and have manufacturer re-inspect and certify the system prior to the scheduled use of the system by the Owner.
 - B. The Contractor is solely responsible for all costs associated with scheduling the manufacturer inspection, the inspection itself and any manufacturer-required re-inspections, and for any modifications to the installation as required by the manufacturers.
- 1.11 WARRANTY
- A. Contractor Warranty:

1. Provide a Contractor-endorsed one-year service warranty against defects in materials and workmanship.
 - a. Provide all labor attributable to the fulfillment of this warranty at no additional cost to the Owner.
 - 1) The Contractor Warranty period shall commence upon Owner acceptance of the work.
 - b. This warranty shall not be voided by Owner's move, add and change activities. The resulting parts of any Owner-performed moves, adds and changes do not become part of the warranty. Nothing in this section shall be construed to terminate the warranty by performance of normal maintenance or service on the system or by expanding the system in any manner consistent with the original design and intent for the system.

B. SCS Manufacturer Warranties:

1. Provide SCS Manufacturer extended product, performance, application, and labor warranties that shall warrant all passive components used in the SCS. Additionally, these warranties shall cover components not manufactured by the SCS Manufacturers, but approved by the SCS Manufacturers for use in the SCS (i.e. "Approved Alternative Products"). The SCS Manufacturer warranties shall warrant:
 - a. That the products will be free from manufacturing defects in materials and workmanship.
 - b. That the cabling products of the installed system shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
 - c. That the installation shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
 - d. That the system shall be application independent and shall support both current and future applications that use the ANSI/TIA/EIA 568-B and ISO/IEC 11801 component and link/channel specifications for cabling.
2. Provide materials and labor attributable to the fulfillment of this warranty at no cost to the Owner.
3. The SCS Manufacturer Warranty period shall commence upon a Warranty Certificate being issued by the manufacturer. The Warranty Certificates shall be issued no later than three months after Owner acceptance of the work.

1.12 SPARE MATERIALS

- A. Provide a minimum of 10% of each pre-terminated fiber used on this project.
- B. Provide a minimum of 10% of each type of wall outlet used on this project.
- C. Provide a minimum of 10% of each type of ONT depicted on the drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products and materials shall be as specified in the pertinent Sections of Division 27. Unless specifically stated as “Or equal”, equivalent items are not acceptable. Provide items as specified.
- B. Wherever possible, all materials and equipment used in the installation of this work shall be of the same Manufacturer throughout for each class of material or equipment. Comply with ANSI, IEEE and NEMA standards, where applicable. Materials shall be new, in original manufacturer packaging, and bear the UL label. Material which has been damaged, removed from original packaging, or exposed to potential damage shall not be installed and shall be replaced at no additional cost to the Owner.
- C. Components shall be manufactured by the manufacturers listed in Division 27. Components shall not be intermixed between different manufacturers unless the manufacturer has listed (in writing) another manufacturer’s component as an “Approved Alternative Product” and will warrant the “Approved Alternative Product” as part of the Manufacturer Warranty.
 - 1. Bid only the manufacturers for which the Contractor is certified.
- D. All copper-related components shall be part of the copper SCS product line and all fiber optic-related components shall be part of the fiber optic SCS product line – components shall not be intermixed between manufacturers’ SCS product lines. The SCS product lines shall be engineered “end-to-end” – the system and all of its components shall be engineered to function together as a single, continuous transmission path.
- E. Physically verify existing site conditions prior to purchase and delivery of the materials, including but not limited to lengths of conduit and/or pathway to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.
- F. Provide materials, devices, equipment or supplies of materials that are inherently non-corrosive or are coated or covered in a manner, acceptable to the Engineer, which renders them non-corrosive. Material that may cause rusting or streaking on a building surface shall not be used.
- G. All cabling and materials that could potentially be installed in ceiling spaces shall be manufacturer-labeled in accordance with NEC 800 to indicate their rating for plenum or non-plenum spaces. Use only plenum-rated materials in plenum-rated spaces.
- H. Provide all incidental and/or miscellaneous hardware (including equipment cables and connectors) not explicitly specified or shown on the Contract Documents that is required for a fully operational, tested, certified and warranted system.
- I. Provide cables of the same type or application in the same color throughout the project, unless otherwise indicated. Multiple colors of the same cable type are not acceptable.

2.2 TOUCH-UP PAINT

- A. Equipment: Provided by equipment manufacturer and selected to match equipment finish.

- B. Non-Equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.3 TELECOMMUNICATIONS FIRESTOPPING

- A. Fires-topping material: 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 test in a configuration that is representative of the actual field conditions.
Manufactured by:
 - 1. Specified Tech. Inc.
 - 2. Hilti
 - 3. or approved equal.
- B. Fire-Rated Cable Pathways: Device modules shall be comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill:
 - 1. Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway
- C. Firestop Pillows: Pillows shall be re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag:
 - 1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows
 - 2. Hilti CP 657 Firestop Brick
- D. Firestop Putty: Putty products shall be re-enterable, non-curing, moldable substances:
 - 1. Specified Technologies Inc. (STI)
 - 2. Hilti

2.4 GROUNDING AND BONDING

- A. As specified under Section 270526 – "Grounding and Bonding for Communications Systems."

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.
- B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

- C. All work shall comply with the standards, references and codes listed in PART 1 – STANDARDS AND CODES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.
- D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.
- E. Equipment Dimensions and Clearances:
 - 1. Dimensions indicated for communications equipment and dimensions indicated for the installation of communications equipment are restrictive dimensions. Verify that equipment will fit within the indicated locations and spaces. Do not use equipment that impinges upon the required clearance, reduces actual clearance, or exceeds the indicated dimensions:
 - a. Except as approved in writing by the Engineer and the Owner.
 - 2. Do not use arrangements of equipment that impinge upon the required clearance, reduce actual clearances or exceed the space allocation.
- F. Equipment Access:
 - 1. Install equipment so it is readily accessible for operation and maintenance.
 - 2. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.
 - 3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.
- G. Equipment shall be installed plumb, square and true with the building construction and shall be securely fastened.
- H. Do not provide materials which contain polychlorinated biphenyls, asbestos or other hazardous or detrimental materials. Do not install materials in a manner, location or construction that produces galvanic action or any other materials corroding or eroding action. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete. Outdoor wall mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion resistant spacers to maintain ¼ inch separation between the equipment and the wall. Screen or seal all raceways or other openings into equipment to prevent the entrance of moisture, rodents and insects.
- I. Drawings indicate the approximate location and arrangement of electrical equipment and the approximate location of other equipment requiring electrical work. The general arrangement of panelboards, outlets and other equipment is diagrammatic and approximate as to locations. To avoid interference with structural members and equipment of other trades, it may be necessary to adjust the intended location of electrical equipment. Where minor changes are required because of structural or finish conditions or for the convenience of the Owner, provide such changes without additional expense to the Owner. Unless specifically dimensioned or detailed, the Contractor may, at his discretion, make minor adjustments in equipment location without obtaining the Engineer's approval. Minor adjustments are defined as a distance not to exceed:
 - 1. 1 ft at grade, floor and roof level in any direction in the horizontal plane.

2. 1 ft for equipment at ceiling level in any direction in the horizontal plane.
3. 1 ft on walls in a horizontal direction within the vertical plane.
4. Changes in equipment location exceeding those defined above require the Engineer's approval.
5. Particular attention shall be paid to door swings, piping, radiation, ductwork, and structural steel:
 - a. In general, waste and vent lines and large pipe mains and ductwork shall be given priority for the locations and space shown.
 - b. No additional compensation will be allowed for the moving of misplaced outlets, wiring, or equipment
- J. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.
- K. Remove surplus material and debris from the job site and dispose of legally.

3.2 SCHEDULE

- A. At least one week prior to commencement of telecommunications-related work, a Pre-Installation Conference shall be held by the Contractor for the purpose of discussing and coordinating the scope of work with the Owner's IT representatives.
- B. Provide a time-scaled construction schedule indicating construction phases and deadlines associated with this work. At a minimum, the following tasks shall be shown on the schedule:
 1. Start of outside plant duct bank and hand hole construction.
 2. Dates of outside plant duct bank concealment (concrete and backfill).
 3. Start of conduit and box rough-in
 4. Start of main campus cable feed to building MDF
 5. Start of MDF and IDF build out
 6. Start of vertical riser cable installation
 7. Start of horizontal cable installation
 8. Start of horizontal cable termination
 9. Date when elevator telephone service required
 10. Date when building automation system (HVAC) will require network service
 11. Start of outlet device termination and labeling
 12. Start of installation testing – provide IT w/preliminary test results.
 13. Start of final inspection process

3.3 INSTALLATION

- A. Install the equipment and materials in a neat and workmanlike manner employing workmen skilled in the particular trade and in accordance with the manufacturer's instructions and industry standards. Maintain adequate supervision of the work by a person in charge at the site during any time that work under this division is in process or when necessary for coordination with other work.

- B. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at fifty-four inches above floors to centerline of controls.
- C. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated, and shall be securely fastened.
- D. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- E. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Attach enclosures with a minimum of three fasteners, and more if the manufacturer so recommends.
 - 1. Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of supplier/manufacturer or the Engineer.
 - 2. Stand equipment off wall surfaces a minimum of one-quarter inch where enclosures are mounted on walls in wet areas (outdoors, below grades, etc.) with neoprene, or fiberglass or plastic shim washers.
 - 3. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
- F. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- G. Give right of way to raceways and piping systems installed at a required slope.
- H. Make all penetrations of electrical work through walls and roofs water and weather tight.
- I. Install concrete pads and bases according to requirements of Division 03 Section "Cast-in-Place Concrete."

3.4 SEISMIC REQUIREMENTS

- A. General: Electrical equipment for emergency systems shall be braced to withstand lateral forces that result from earthquakes. The Electrical Contractor shall provide seismic calculations stamped and signed by a registered Structural Engineer confirming size, number and location of all required anchoring hardware. Electrical equipment vendors shall submit weights, dimensions and center of gravity location for all emergency electrical equipment for this purpose.

3.5 PAINTING

- A. General: All finish painting of electrical equipment shall be as specified in Division 9, unless equipment is herein-after specified to be furnished with factory applied finish coats. Equipment to be field painted shall be supplied with factory applied prime coat.

- B. Touch Up: If factory finish on any equipment furnished under this Division is damaged in shipment or during construction of the building, equipment shall be refinished by Contractor to the satisfaction of the Architect/Engineer.
- C. Concealed Equipment: All uncoated cast iron or steel that will be concealed or will not be accessible when installations are completed shall be given one heavy coat of black asphalt before installation.

3.6 CONCRETE WORK

- A. All concrete required for communications work shall be provided under Division 33.

3.7 FIRESTOPPING

- A. Comply with requirements in Division 07 – “Fire-stopping.”
- B. Only employees trained/certified by the fire-stopping manufacturer shall apply fire-stopping materials.
- C. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.
 - 1. Provide fire-stopping material for through and membrane penetrations of fire-rated barriers.
 - 2. Install firestops in strict accordance with manufacturer’s detailed installation procedures.
 - 3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.
 - 4. For demolition work, apply fire-stopping to open penetrations in fire rated barriers where cable is removed. Apply fire-stopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.
 - 5. Fire-stopping material used to seal open penetrations through which cable passes shall be reusable/re-enterable.
- D. Fire and smoke stopping cable pathway devices shall be provided for all sleeve penetrations through fire-rated walls and wherever cables (not in conduit) pass through fire-rated walls. Devices shall be arranged singly or in gangs, and installed in strict accordance with the manufacturer’s recommendations. Apply the factory supplied gasketing material prior to the installation of the wall plates. Secure wall plates to devices per the equipment manufacturer’s recommendations.
 - 1. Putty-type fire-stopping products are not acceptable.
- E. Fire and smoke stopping cable pathway devices shall be provided for all floor-to-floor fire-stopping applications.
- F. Fire-stopping putty and fire-stopping pillow products shall not be used for vertically oriented applications.

3.8 GROUNDING AND BONDING

- A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – STANDARDS AND CODES above, as well as local codes which may specify additional grounding and/or bonding requirements.
- B. Provide grounding and bonding as required under Section 270526 – “Grounding and Bonding for Communications Systems” and as required under other Division 27 sections.

3.9 PROTECTION, CARE AND CLEANING

- A. Protection: Provide adequate protection for all finished parts of the materials and equipment against physical damage from any cause during the progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.
- B. Care: During construction, properly cap all lines and equipment to prevent the entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.
- C. Cleaning: After installation has been completed, clean all systems as follows:
 - 1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment exposed in completed structure; removing rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.
 - 2. Factory Finished Items: Remove grease, oil and dust on factory finished items such as cabinets and racks, and rack-mounted equipment, and leave surfaces clean and polished. Vacuum inside of all electrical equipment and remove dust and debris.
- D. Connections: Prior to energizing, check all electrical connection hardware.

3.10 DAMAGE AND REPAIRS

- A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor's warranty or relieving the Contractor of his responsibility during the warranty period.
- B. Responsibility for Damage: Contractor shall be responsible for damage to the grounds, buildings, or equipment due to work furnished or installed under this Division.

3.11 SERVICE OUTAGES

- A. Any telephone, data or television service outage required to perform work under this Contract shall be performed at a time that is coordinated with and convenient to the Owner. Submit to the Owner (in writing) for his approval, a schedule showing the dates and times the Contractor desires to perform his work. This schedule shall be submitted no less than five days prior to commencing work. It may be necessary to perform this work at night, on holidays or maintenance shutdowns. The Contractor shall include in his bid all premium time labor costs for this work.

3.12 IDENTIFICATION AND LABELING

- A. General: Labeling and administration shall comply with ANSI/TIA/EIA 606 and standard industry practices.
- B. Identifiers shall be defined for all communications features, equipment, racks, terminations, conduits, cable trays, faceplates, cabling and grounding/bonding systems as required in Division 27. Identifiers shall be consistent with the Owner's standard labeling scheme.
- C. Labels shall be prepared using machine-printed equipment, producing indelible text on durable label materials. Handwritten labels are not acceptable.
- D. Labels shall be affixed to each item, showing the identifier of that item, and arranged such that they are readable after cabling has been dressed and secured.
- E. Identifiers shall be shown on As-built Drawings.

3.13 TESTING

- A. Test every cable in the project, in accordance with Contract requirements, manufacturer requirements, industry standards, and warranty requirements and as required in Division 27.
- B. Notify the Owner's representative (ITPM) two weeks prior to the start of testing, and invite the Owner's representative to witness the testing.
- C. Prior to the start of testing, submit for Owner review and approval the proposed test procedures, test report forms and timetable for performing the required testing.
- D. Provide test records on a form approved by the Owner and Engineer. Submit the test results for each cable. The records shall include the unique cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Engineer for review and acceptance within three weeks of Substantial Completion.
 - 1. Prepare and submit the test results in Adobe Acrobat PDF electronic form (on a flash drive or CDROM) to the Owner and Designer for review. Handwritten test results will not be accepted.
 - 2. The CDROM shall be labeled with the words "Test Results", the project name, and the date of completion (month and year).
 - 3. Test data on the CDROM shall be organized into three folder categories as follows:
 - a. Inter-building Feeders
 - b. Intra-building Risers
 - c. Intra-building Horizontal
 - 4. Each major heading shall be sub-sectioned by test type. For example, within the Inter-building and Intra-building sections, the following subsections or sub-files shall be created:
 - a. Scanner Test Results (Category 3 or Category 6)
 - b. Fiber Optic Attenuation Test Results
 - c. OTDR Traces

- d. Power Meter Readings
 - e. Green Light Test Results
 - 5. Test data within each section shall be presented in the sequence listed in the administration records. Information about the test equipment shall also be provided, including:
 - a. the name of the test equipment
 - b. manufacturer
 - c. model number
 - d. the date of the most recent calibration.
 - 6. Test equipment shall be calibrated as often as the manufacturer specifies, or annually, whichever is more frequent.
 - 7. The CDROM shall also include a PDF-printed description of each test method used and the specific settings of the equipment used to perform each type of testing.
 - 8. Any test-report anomalies discovered during review by the Owner or Engineer shall be resolved promptly by the Contractor at no additional cost to the Owner. Installation deficiencies shall be corrected, the testing redone and an updated CDROM containing a comprehensive set of all test reports (not just the portion requiring correction) shall be prepared and submitted to the Owner and Engineer.
 - a. The original test reports (showing the unacceptable results) shall also be included on the CDROM in a subfolder under the corresponding category.
 - E. Costs of test shall be borne by Contractor. Contractor shall provide all instruments, equipment, labor and materials to complete test. Should tests detect any defective materials, poor workmanship or variance with requirements of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.
- 3.14 AS-BUILT DRAWINGS
- A. Upon completion and at other times during the progress of the work, when required, remove all surplus materials, rubbish and debris resulting from the work.
- 3.15 PRELIMINARY OPERATION
- A. The Owner reserves the right to operate portions of the communications system on a preliminary basis without voiding the warranty or relieving the Contractor of his responsibilities.
- 3.16 CLEAN-UP
- A. Upon completion and at other times during the progress of the work, when required, remove all surplus materials, rubbish and debris resulting from the work, and dispose of legally.

3.17 DEMONSTRATION

- A. Demonstrate equipment in accordance with Division 01.
- B. Provide assistance to the Engineer during the demonstration or observation of equipment by operating devices and equipment, opening enclosures for inspection, checking as-built drawing information, and similar tasks, as necessary in the Engineer's judgment, to verify all work performed.
- C. Acceptance Is Contingent On:
 - 1. Completion of final review and correction of all deficiencies.
 - 2. Satisfactory completion of acceptance tests which demonstrate compliance with all performance and technical requirements of Contract Documents.
 - 3. Satisfactory completion of training program and submission of all manuals and drawings required by Contract Documents.

3.18 OWNER-PROVIDED SERVICES

- A. The Owner will provide the following services:
 - 1. Install station patch cords and/or cross-connect "jumpers" for voice and data.
 - 2. Connections to the Local Exchange Carrier, and Inter-exchange Carrier.

END OF SECTION 27 0500

SECTION 27 0526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor for the installation of a grounding and bonding system for inside plant telecommunications infrastructure. This section includes requirements for providing a permanent grounding and bonding infrastructure for horizontal and backbone communications circuits, equipment racking, raceways, and cable tray. These requirements are in addition to any that may exist in Section 26 – “Grounding.”

1.2 SYSTEM DESCRIPTION

- A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete, permanent Grounding and Bonding infrastructure for communications circuits, raceways, and cable trays as hereinafter specified and/or shown on the Contract Documents. The Grounding and Bonding system shall support an ANSI/TIA/EIA and ISO/IEC compliant communications Structured Cabling System (SCS) as specified in Section 271100 – “Communications Equipment Room Fittings” and Section 338200 – “Communications Distribution.”
- B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant Grounding and Bonding system.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials shall consist of busbars, supports, bonding conductors and other incidentals and accessories as required.

2.2 GROUNDING/BONDING:

- A. Telecommunications Main Grounding Bus Bar (TMGB):
 - 1. Large (20” x 4” x ¼”), Pre-drilled: CPI 10622-020 or Panduit GB2B0312TPI-1
- B. Telecommunications Bonding Backbone (TBB): #2 AWG or #250 kcmil insulated (green in color) copper conductor.
- C. Grounding Conductor: #6 AWG insulated (green in color) copper conductor.
- D. Grounding Conductor: #6 AWG bare copper conductor.

2.3 LABELS:

- A. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.
 - 1. Labels:
 - a. Panduit Marker Tie (or approved equal)
 - b. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)
 - 2. Hand-carried label maker:
 - a. Brady: ID Pro Plus (or approved equal).

PART 3 - EXECUTION

3.1 GENERAL

- A. Install the grounding and bonding system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA standards.

3.2 INSTALLATION

- A. The grounding and bonding infrastructure system shall not make use of the building plumbing system, unless required to do so by the NEC.
 - 1. Coordinate the installation of the grounding and bonding system with the electrical power distribution system grounding infrastructure.

3.3 GROUND/BONDING:

- A. TMGB: Provide a minimum of one TMGB per main telecommunications room ("MDF") for each building and as shown on the Contract Documents. Install TMGB(s) and directly bond TMGB(s) to electrical service ground and to associated TBB(s). Group protector, bus bar bonding, and approved building grounding conductors toward the left end and leave space for equipment grounding conductors to the right end.
- B. TBB(s): Provide TBB(s) as shown on the Contract Documents and as required to bond TMGB to building main electrical ground and to bond all TGBs to the TMGB.
 - 1. Route along the shortest and straightest path possible with minimal bends.
 - 2. Bends shall be sweeping.
 - 3. Insulate TBB(s) and conductors from their support.
 - 4. TBB(s) shall be continuous (without splices).
- C. Grounding Conductors: Provide grounding conductors as shown on the Contract Documents and as required to bond all non-current carrying metal telecommunications equipment and materials to the nearest TGB.

1. Route along the shortest and straightest path possible with minimal bends.
2. Bends shall be sweeping.
3. Insulate grounding conductors from their support.
4. Grounding conductors shall be continuous (without splices).
5. Bare conductors shall be provided for cable trays, wire mesh trays and wire gutter.
6. Insulated conductors shall be provided in telecommunications rooms.
7. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.

D. Special Applications:

1. Exterior Wireless Access Point Panels: Provide a Narrow grounding bus bar as shown on the Contract Documents. Install bus bars and bond bus bars to associated TBB(s).

3.4 LABELS:

- A. Label TMGB(s) with "TMGB". If the TMGBs are existing and unlabeled, provide labels for each.
- B. Label TGB(s) with "TGB". If the TGBs are existing and unlabeled, provide labels for each.
- C. Label TBB(s) and bonding conductors "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

END OF SECTION 27 0526

SECTION 27 0533 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor for the installation of a pathway system for inside plant communications circuits. This section includes requirements for horizontal and building backbone raceways, fittings, and boxes specific to communications circuits (cabling) for voice and data.

1.2 SYSTEM DESCRIPTION

- A. Furnish and install a complete conduit raceway system for communications circuits in accordance with ANSI/TIA/EIA and BICSI TDMM standards.
- B. The work shall include conduit, outlet boxes, fittings, enclosures, pull boxes, and other raceway elements and accessories as required for a complete structured cabling system.

1.3 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation" and with NEC Quality assurance.

1.4 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other trades to ensure adequate headroom, working clearance, and access as required by ANSI/TIA/EIA and BICSI TDMM standards.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials shall consist of conduit, surface raceway, outlet boxes, fittings, enclosures, pull boxes, and other raceway incidentals and accessories as required for inside plant communications circuits.

2.2 MATERIALS

A. Conduit:

1. EMT: 3/4" trade size minimum.
 - a. Conduit: Galvanized steel tubing meeting ANSI C80.3.
 - b. Fittings: Set screw type.
 - c. Connectors: Threaded/locknut type. Snap in type not permitted.

B. Sleeves: EMT conduit, with insulated throat bushings for each end and ground wire clamp on one end.

C. Conduit Waterfalls: 4" trade-size minimum.

D. Outlet boxes: Minimum 4-11/16" x 4-11/16" size, 2 7/8" minimum depth, with extension rings (if needed) and double gang covers (i.e. mud rings), unless otherwise noted on the Contract Documents. Welded steel, galvanized, with knockouts for 1" trade size conduit or connector entrance.

E. Pull Boxes and Junction Boxes

1. Metal Pull and Junction Boxes: Steel, finished inside and out with manufacturer's standard enamel finish.
2. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
3. Provide pull boxes and junction boxes with blank cover plates.
4. Size Pull Boxes per BICSI TDMM Standards.

F. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

2.3 GROUNDING AND BONDING

A. Grounding Conductor: #6 AWG bare copper conductor.

B. Bonding lugs and screws: UL Listed, NEC compliant, rated for use with grounding and bonding, and sized appropriate for the application.

2.4 LABELING AND ADMINISTRATION

A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

1. Labels:
 - a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)
 - b. Hand-carried label maker: Brady: ID Pro Plus (or approved equal).
2. Labeling shall comply with ANSI/TIA 606B and BICSI TDMM standards.

PART 3 - EXECUTION

3.1 GENERAL

- A. The telecommunications raceway system shall be installed in accordance with ANSI/TIA/EIA and BICSI TDM Standards.

3.2 EXAMINATION

- A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Notify the Engineer/Owner of conditions that may adversely affect the installation, subsequent use, or cause the conduits (or circuits to be subsequently installed in the conduits) to not comply with ANSI/TIA/EIA standards.

3.3 INSTALLATION

- A. Raceways and boxes shall be installed per manufacturer's recommendations. Provide a dedicated raceway and box for each circuit, daisy chaining circuits is not permitted.
- B. Conduit:
 - 1. Provide EMT unless otherwise within the drawings.
 - 2. Provide RMC for outdoor applications and where RMC is required by Code.
 - 3. Conduits shall be run in the most direct route possible and follow parallel to building lines.
 - 4. Maintain a minimum of 6 inches clearance between parallel runs of conduit and steam or hot water pipes.
 - 5. Keep conduit away from sources of electromagnetic interference as follows:
 - a. 5 inches from fluorescent lighting
 - b. 12 inches from conduit and cables used for electrical power distribution
 - c. 48 inches from motors or transformers
 - 6. Do not exceed 295' total length for a given conduit run to be used for distribution cabling. Total conduit run is to include intermediate conduits and junction boxes.
 - 7. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 8. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - a. Run parallel or banked raceways together on common supports.
 - b. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

9. Conduits shall be reamed to eliminate sharp edges and terminated with metallic insulated grounded throat bushings. Care shall be taken to ensure that conduits remain clean, dry and free of foreign material until cabling is installed.
10. Terminate riser conduits at 4" above finished floor of IDF rooms and no more than 4" from the wall.
11. Where conduit is embedded in concrete, install in middle 1/3 of slab thickness where practical and leave at least 2" of concrete cover.
 - a. Secure conduits to reinforcing rods to prevent sagging or shifting during concrete placement.
 - b. Space conduits laterally to prevent voids in concrete.
 - c. Do not place conduit in concrete less than five inches thick. Instead, route conduit beneath concrete.
 - d. Run conduit parallel to main reinforcement.
 - e. Conduit crossovers in concrete are not permitted.
 - f. Conduits embedded in concrete shall be 1 1/4" minimum.
12. Install raceways in maximum lengths of 100' and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements. Pull or junction boxes shall not be used as a bend.
13. Terminate conduits no more than 8" from cable tray, only where conduits are homerun to cable tray.
14. For conduit greater than 1" in diameter, provide standard factory sweeps or conduit fittings for all conduit bends and offsets.
 - a. Conduit sweeps:
 - 1) Sweeps shall not exceed 90 degrees.
 - 2) Do not exceed 180 degrees for the sum total of conduit sweeps for a section of conduit (between conduit termination points).
 - 3) Sweep radius shall be at least 10 times the internal diameter of the conduit.
 - 4) 90-degree condulets (LBs) and electrical elbows are not acceptable.

C. Sleeves:

1. Provide conduit sleeves where indicated on the contract documents. Where conduit sleeves are required but not shown, provide sleeve per ANSI/TIA/EIA 569A cable capacity standards. Provide additional conduit sleeves to maintain 100% spare for future expansion.
2. Provide roto-hammering or core drilling where required for installation.
3. All penetrations shall be sealed with firestopping material to restore wall or floor to pre-penetration fire rating.

D. Outlet Boxes:

1. Provide outlet boxes of the appropriate size and quantity as indicated on the contract documents. Provide extension rings as needed.
2. Ensure communications boxes installed in wet, hazardous or corrosive locations are constructed of the appropriate material.
3. Install boxes at heights as indicated on drawings.

3.4 GROUNDING/BONDING:

- A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, UL 467, ANSI/TIA/EIA standards and the references listed in Section 270500 – “Common Works Results for Communications” PART 1 – STANDARDS AND CODES, as well as local codes which may specify additional grounding and/or bonding requirements.
 - 1. Bond metallic raceway together and to the nearest TGB (as provided under Section 270526 – “Grounding and Bonding for Communications Systems”). Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.
- B. Conduits and Sleeves:
 - 1. For conduits and sleeves terminating at a cable tray, provide a bonding conductor to the cable tray grounding conductor, terminated with bonding lugs. Where multiple conduits terminate adjacent to each other, it is permissible to daisy-chain the bonding conductor between conduits and route a single conductor to the cable tray grounding conductor.
 - 2. For conduits and sleeves terminating in a telecommunications room, provide a bonding conductor to the TGB or TMGB in that room. Where multiple conduits terminate adjacent to each other, it is permissible to daisy-chain the bonding conductor between conduits and route a single conductor to the TGB or TMGB.
- C. For Wire Gutter:
 - 1. Provide a continuous grounding conductor running the length of the wire gutter.
 - 2. Bond each section of wire gutter to the grounding conductor.
 - 3. Ensure that the grounding/bonding hardware breaks through painted surfaces.

3.5 JUNCTION BOXES:

- A. Provide junction boxes as shown on the Contract Documents and as required per the BICSI TDMM.
- B. Size junction boxes per BICSI TDMM.

3.6 LABELS:

- A. Conduits: Label each conduit end in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, outlet identifier, etc.). Use the label of the first port of the outlet as the outlet identifier. Indicate conduit length on the label.
 - 1. Where a conduit is intended for future cabling use outside of the Contract, the conduit shall be labeled in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, etc.) along with a sequential number for each spare conduit terminated into a single room. Indicate conduit length on the label.

- a. Suggestion: The second spare conduit (whether spare or in use) between Room 100 and telecommunications room 1A might be labeled in the telecommunications room as “100 - #2, ___ feet.” In Room 100 the same conduit might be labeled “1A - #2, ___ feet.”
- B. Pull Boxes: Label each pull box with a unique identifier. Identifiers shall be of the form “RN-Y” where “RN” is the room name of the room closest to (or containing) the pull box, and “Y” is the sequential number of the pull box for each “RN”.
 1. Example: The second pull box in the vicinity of room “100” would have the label “100-2”.

3.7 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

- A. On completion of installation (including outlet fittings and devices), inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 27 0533

SECTION 27 0536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered in this section consists of cable tray systems for communication systems.

1.2 SYSTEM DESCRIPTION

- A. Furnish and install a complete cable tray system for communications circuits in accordance with ANSI/TIA/EIA and BICSI TDMM standards.
- B. Provide a complete system including materials and equipment not specifically mentioned within this specification but that are required to complete the work in accordance with the relevant standards.

1.3 STANDARDS AND CODES

- A. The applicable portions of the following specifications, standards, codes and regulations shall be incorporated by reference into this section:
 - 1. ASTM A123 – Specification for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
 - 2. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical) Quality.
 - 3. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low Alloy and High-Strength Low-Alloy with Improved Formability.
 - 4. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low-Alloy with Improved Formability.
 - 5. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 6. NEMA VE 1 – Metallic Cable Tray Systems
 - 7. NEMA VE 2 – Cable Tray Installation Guidelines

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials shall consist of tray sections, tray fittings, connectors, supports, expansion joints, blind end plates, barrier strips, radius drops, bonding conductors and other incidentals and accessories as required. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Contract Documents that is required for a fully operational and warranted system.

- B. Unless specifically stated as “Or equal”, equivalent items are not acceptable. Provide items as specified.
- C. Physically verify existing site conditions prior to purchase and delivery of the materials.
- D. Except for the use of ladder rack and wire basket tray where indicated, open bottom type cable trays, where cable and wiring are exposed to view are not acceptable.
- E. Structure of trays shall be suitable to support a continuous loading of cables weighing 75 pounds per linear foot, when supported on 12 foot centers, without any deflection exceeding 1/100 of the span, with a safety factor of 1.50.
- F. Interior surfaces shall be smooth and free of offset edges, projections or misalignment. Assembly bolts for end to end connections shall have a pattern which does not cause damage to cable sheaths of jackets. All edges shall be smooth, rounded and de-burred.

2.2 WIRE BASKET (MESH) TRAY

- A. Wire mesh tray components shall be manufactured by a single manufacturer. Components shall not be intermixed between different manufacturers.
 - 1. The cable tray manufacturer shall be one of the following:
 - a. Cooper Industries - Flextray
 - b. Legrand Cablofil
 - c. Or pre-approved equal
- B. Wire mesh tray shall be constructed of welded steel wire with a continuous safety edge wire lip. Tray shall be complete with all supports, materials, and miscellaneous hardware required for a complete cable tray system.
 - 1. Finish: Carbon steel with electro-plated zinc galvanized finish.
 - 2. Width: Provide widths as indicated on the drawings. Cable tray width shall not be less than 12” minimum.
 - 3. Depth: Provide depths as indicated on the drawings. Cable tray depth shall not be less than 4” minimum.
 - 4. Fittings: Fittings shall be field-fabricated from straight sections using manufacturer-approved tools and in accordance with manufacturer’s instructions.
 - 5. Accessories: All accessories shall be factory-fabricated by the manufacturer.
- C. Wire mesh cutting tools shall be manufacturer-approved with “offset cutting blade” jaws and a minimum 24 inch handle, and able to produce clean cuts without ragged edges.

2.3 SUPPORTS

- A. Utilize center hung style hanger supports, spacing shall be per manufacturer recommendation.

2.4 GROUNDING AND BONDING

- A. Provide grounding and bonding of cable tray system per Division 27 Section 270526.

2.5 FIRESTOPPING MATERIAL

- A. Firestopping material: 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 test in a configuration that is representative of the actual field conditions.
Manufactured by:

1. Specified Tech. Inc. EZ-Path, with ganging brackets.

2.6 LABELING AND ADMINISTRATION

- A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

1. Labels: Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)
2. Label Clips: Cablofil, Inc. (regardless of wire mesh tray manufacturer)
3. Hand-carried label maker: Brady: ID Pro Plus (or approved equal).
4. Labeling shall comply with ANSI/TIA 606B and BICSI TDMM standards.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install the cable tray system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA Standards.

3.2 EXAMINATION

- A. Examine surfaces and spaces to receive cable tray for compliance with installation tolerances and other conditions affecting performance of cable tray installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Notify the Engineer/Owner of conditions that may adversely affect the installation, subsequent use, or cause the tray (or circuits to be subsequently installed in the tray) to not comply with ANSI/TIA/EIA standards.

3.3 INSTALLATION

- A. Install a complete cable tray system. There shall be no gaps, missing accessories. All accessories must be from same manufacturer of cable tray. Do not make field modification of accessories.
- B. Remove burrs and sharp edges from cable trays.
- C. Provide cable tray, in the locations, widths and depths shown within the drawings set and in accordance with manufacturer's requirements and industry standards.

- D. Provide fire stopping as required by the NEC.
- E. Provide a minimum of 8" clear space above cable tray for accessible working space. Other building trades may run perpendicular to cable tray at heights of less than 8" as long as tray remains accessible at regular intervals.
- F. Cable tray supports shall be provided and installed per manufacturer recommendations. Manufacturer recommendations are to be considered a minimum standard to comply to. Install additional supports where required by the contract documents.
- G. Where cable tray is mounted above accessible ceiling space or hard lid ceiling, mount cable tray at +4" above ceiling tile.
- H. Where cable tray is exposed, refer to floor plans, sections and elevations within the drawing set for cable tray mounting height.

3.4 GROUNDING AND BONDING

- A. Provide grounding per Section 270526 – "Grounding and Bonding for Telecommunications"

3.5 CLEANING AND PROTECTION

- A. On completion of installation, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 TESTING

- A. Test cable trays to ensure electrical continuity of bonding and grounding connections. Demonstrate compliance with maximum grounding resistance per NFPA 70B, Chapter 18.

3.7 LABELING AND ADMINISTRATION

- A. Provide the following label every 10 feet along the entire length of the cable tray:
 - 1. Label shall read "TELECOMMUNICATIONS / LOW VOLTAGE CABLING ONLY".

END OF SECTION 27 0536

SECTION 27 1100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor for the installation of telecommunications cabinets, racks, frames, enclosures, cable management, and power hardware. This section includes hardware that supports the specified Structured Cabling.
- B. Products installed (but not furnished) under this section:
 - 1. Grounding Conductor

1.2 SYSTEM DESCRIPTION

- A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances associated with telecommunications cabinets, racks, frames, enclosures, cable management, and power hardware to support an ANSI/TIA/EIA, NECA/NEIS and ISO/IEC compliant communications Structured Cabling System (SCS) as shown on the Contract Documents.
- B. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant SCS.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Cabinets, ladder rack, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this Specification or in the Contract Documents. Do not intermix equipment and components between different manufacturers.
 - 1. Cabinet/Distribution Equipment: Chatsworth Products, Inc. (CPI)

2.2 CABLE SUPPORTS

- A. Backboards:
 - 1. $\frac{3}{4}$ inch A-C grade, fire-retardant plywood backboards, void free, 8 feet high, mounted at +6" above finished floor, unless otherwise noted. Provide a minimum of 2 coats light colored paint.
- B. Cable Supports:

1. D-Rings:
 - a. Metallic: CPI 10941, 10942, 10943
2. Saddle-backs
3. Cable Clamps

C. Ladder Rack:

1. Ladder racks shall have maximum load with minimal deflection of 45 lbs/ft when supported every 5 feet.
2. Ladder rack shall be manufactured by CPI or approved equal.
3. Field constructed accessories such as transitions, splices, bends are prohibited.
4. Provide manufactured junction splices to join pieces of ladder rack.
5. Ladder rack and accessories shall be black in color.

2.3 EQUIPMENT CABINETS/ENCLOSURES

A. General: Equipment cabinet shall be either freestanding or wall mounting equipment cabinet and size as indicated in Drawings. Equipment cabinet shall be modular steel unit and equipped with the following:

1. Fans for ventilation. Minimum airflow shall be 190 L/s (400 cfm) unless noted otherwise (with concurrence of OBO/PDCS/DE project engineer).
2. Hinged doors with reversible swing and lock for protection.
3. Rail conforming to EIA 310-D standard for mounting standard 482-mm equipment. Rail shall have untapped holes; they shall not be threaded.
4. Grounding busbar kit inside equipment cabinet.
5. Transparent front door and vented rear door.
6. Power strip with surge protection and minimum of 6-receptacle outlets on power strip.
7. Vertical wire management extending full height of cabinet including both sides, as well as front and back.
8. Knockouts for cable accessed along top, bottom, or rear panels.
9. Freestanding Equipment Cabinets:

a. Basis of Design

- 1) CPI: Z4-11U-113 (48" deep x 78" high x 24" wide).
- 2) Verify with owner for latch type.
- 3) Perforated reversible front and back door with approximately 63 percent opening.
- 4) Lift-off side panels.
- 5) Finish: Manufacturer's standard Black

B. Grounding kit and #6 AWG insulated copper conductor grounded to the nearest TGB.

1. CPI: CPI grounding kit

C. Incidental materials required for proper construction, mounting and securing.

2.4 IN-LINE UPS

- A. System Performance: UPS and associated equipment shall operate in conjunction with primary power supply and output distribution system to provide quality uninterrupted power for mission critical, electronic equipment load.
- B. UPS Capacity: Size for 30kVA as indicated on Drawings.
- C. Housing: House system components in standard equipment cabinet consistent with the server cabinets specified within this section.
- D. System Input:
 - 1. AC Input Nominal Voltage: 208V 3Ø.
 - 2. Maximum Frequency Range: 55-65Hz (autosensing).
 - 3. Input Power Factor: Greater than 0.99 at load greater than 25.
 - 4. Input Current Distortion with no additional filters: Less than 5 percent at 100 percent load.
 - 5. Soft-Start: Shall be linear from 0-100 percent input current, and shall not exhibit inrush. Soft-start shall take place over 10 seconds time period.
- B. In-line UPS shall be Eaton 9355-30 or approved equal.

2.5 RACK MOUNTED DC POWER SYSTEM

- A. Rack mounted DC power systems shall be manufactured by Edge Power Solutions and shall have the following minimum features:
 - 1. 32 12AWG-24AWG spring load interfaces
 - 2. 98 watts power per output
 - 3. 56VDC
 - 4. 120VAC input
 - 5. Ethernet connectivity.
- B. Rack mounted DC power system shall be EPS IPC-32-1RU or equal.

2.6 GROUNDING AND BONDING

- A. As specified under Section 270526 – “Grounding and Bonding for Communications Systems.”

2.7 LABELING AND ADMINISTRATION

- A. Labels:
 - 1. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.
 - a. Station Cable:

- 1) Brady: Brady maker Wire Marking Labels WML-511-292 (or approved equal)
 - b. Backbone Cable:
 - 1) Panduit Marker Tie (or approved equal)
 - c. Labeling shall comply with ANSI/TIA 606B and BICSI TDMM standards.
- B. Hand-carried label maker:
1. Brady: ID Pro Plus (or approved equal).

PART 3 - EXECUTION

3.1 GENERAL

- A. All plumbing, drains, piping, unrelated HVAC ductwork, and other utilities that are not related to telecommunications shall be routed around telecommunications rooms. Only utilities that serve telecommunications rooms shall enter telecommunications rooms.

3.2 CABLE SUPPORTS

- A. Backboards: Provide backboards as shown on Contract Documents. Backboards shall be capable of supporting attached equipment.
1. Mount A-C plywood backboards with the "A" side exposed, with flush or countersunk fasteners, and with the joints butted tight.
 2. Mount backboards 9 inches above finished floor, such that the top of the backboard reaches 8 feet 9 inches above finished floor, unless otherwise indicated.
 3. Paint backboards with a minimum of two coats (over primer) of white colored satin paint.
- B. D-Rings: Provide D-Rings as necessary to route exposed backbone cables in telecommunications rooms and on backboards and for raceway for routing cable in non-exposed open access environments, and as shown in the Contract Documents. D-Rings may be affixed to wall/ceiling structures or other supports, but not attached to a ceiling support system. In telecommunications rooms, mount D-Rings at 12 inch intervals and as shown in the Contract Documents.
1. Size D-Rings as noted in the Contract Documents.
 2. Where not noted, size D-Rings according to the type and quantity of cable to be routed through the ring per TIA/EIA 569 cable capacity standards, plus an additional 100% for future expansion, but not less than a minimum of 2 inches in diameter.
 3. D-Rings are not permitted outside of telecommunications rooms unless otherwise indicated in the Contract Documents.
 4. Horizontal cables shall be routed via overhead and vertical ladder racking (not via D-Rings).

- C. Ladder Rack: Provide ladder racking, sized and in locations as shown on the Contract Documents, installed per manufacturer's instructions with flat (rung) side up. Install ladder rack affixed to top of equipment racks at 7 feet 0 inches above finished floor (unless otherwise indicated) to serve as equipment rack bracing.
1. Cut ends of ladder rack square. Ream cut ends to remove burrs and sharp edges. Cap cut ends with manufacturer's recommended caps.
 2. Provide 90-degree horizontal radius bends for each 90-degree change in direction of ladder rack angle.
 3. Provide cable runway grounding kits across ladder rack splices and where ladder racks are connected to equipment racks/cabinets.
 4. Provide cable retaining posts at 2 foot intervals and at each corner and junction as follows:
 - a. The inside of ladder rack (away from wall), where rack is mounted adjacent to a wall.
 - b. Both sides of ladder rack where rack is not mounted adjacent to a wall.
- D. Vertical Ladder Rack: Provide vertically mounted ladder racking attached to walls, anywhere in telecommunications rooms where cabling changes elevation by 24 inches or greater, and also in locations shown on the Contract Documents. Size vertical ladder racking as shown on Contract Documents, 12 inches wide minimum.

3.3 EQUIPMENT CABINETS/ENCLOSURES

- A. Provide EIA cabinets and all associated hardware according to locations, elevations, and plan views as shown in the Contract Documents.
- B. Floor Mount Cabinets:
1. Using ladder rack, horizontally affix the top of a given rack/cabinet to the wall as shown on the Contract Documents. Bolt horizontal ladder rack to rack/cabinet and to walls. Bolt rack/cabinet to floor.
- C. All rack accessories and screws provided with the racks but not installed shall be bagged and left with the rack upon completion for Owner's future use.

3.4 GROUNDING AND BONDING

- A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in Section 270500 – "Common Works Results for Communications" PART 1 – STANDARDS AND CODES, as well as local codes which may specify additional grounding and/or bonding requirements.
1. Provide a minimum of one wall-mountable telecommunications ground bus bar per telecommunications room and as shown on the Contract Documents.
 2. Grounding conductor shall be installed to bond all non-current carrying metal telecommunications equipment and materials to the nearest TMGB or TGB (as provided under Section 270526 – "Grounding and Bonding for Communications Systems").

- a. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.
- b. Provide ladder rack grounding kits to bond each section of ladder rack and bond ladder rack to racks/cabinets where ladder racks are connected.

3.5 LABELING AND ADMINISTRATION

- A. Telecommunications Rooms: Affix a permanent label with the telecommunications room number on the wall above the light switch inside each telecommunications room. Where telecommunications room names are required in other labels, use the telecommunication room name shown on the Contract Documents.
- B. Cabinets: Label racks as shown on the Contract Documents. Affix label centered across top cross- member of rack and on the foot-plate. Labels shall read "Rack 1", "Rack 2", "Rack 3", etc. as shown on the Contract Documents.

END OF SECTION 27 1100

SECTION 27 1300 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered in this section consists of outside plant fiber optic cabling, outside plant fiber optic terminations, fiber optic patch panels, riser copper terminations, riser fiber optic cable, riser fiber optic cable terminations and riser copper cabling.

1.2 SYSTEM DESCRIPTION

- A. Provide and install all backbone fiber optic and copper cabling and components as indicated within the drawing set and these specifications. Components required but not specifically identified shall be provided to ensure a complete and functioning system.
- B. All work shall be completed in accordance with ANSI/EIA/TIA and BICSI standards.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pathways shall be provided in accordance with specification sections 260530 "Conduit", 270529 "Hangers and Supports for Communications Systems", 270533 "Conduits and Backboxes for Communications Systems", and 270536 "Cable Tray for Communications Circuits."
- B. Telecommunications cabling system components such as cable, jack, termination blocks, and patch panels shall be of one manufacturer or product line.
- C. All backbone cabling and components shall be manufactured by Corning, Commscope or equal, unless specifically noted otherwise.

2.2 FIBER OPTIC TERMINATIONS

- A. The Contractor shall Provide and Install Fiber Optic Cable Termination enclosures and Closet Management Panels for this building. The enclosures shall be equal to Corning/LAN- scape, CCH-04U, rack-mounted distribution panel, shall be mounted immediately below the Closet Jumper Management Panel (CJP-01U), and shall use the following connectors:
 - 1. LC Bulkhead Connectors for single-mode fiber strands shall be LC/UPC duplex ceramic inserts with composite housing.
 - 2. All Fiber Optic Strands (backbone) shall be "Fusion Spliced" to respective Factory Terminated 24 in long pigtails equipped with the appropriate LC Connector at all termination points.

- B. Fiber Optic Cable Termination enclosures for all Buildings shall be equal to Corning/LANscape Fiber Optic Distribution Unit (FODU), equipped with a Closet Jumper Management Panel (CJP-01U). The contractor shall Provide and Install all FODUs, and Connector Panels equipped with the appropriate Bulkheads (LC for Single-mode fiber strands).

2.3 OUTSIDE PLANT FIBER OPTIC CABLING

A. OSP Fiber Optic Cables:

- 1. The Contractor shall provide, install, terminate and test fiber optic cabling, equal to Corning Freedom loose-tube, indoor/outdoor-rated hybrid, OFNR cable, 12SM.

2.4 INNERDUCT

A. Intra-building innerduct shall be 1-1/4 inch size, orange, un-split, corrugated, with pull tape:

- 1. Carlon
- 2. Dura-line
- 3. Or approved equal

2.5 LABELING AND ADMINISTRATION

A. Labels:

- 1. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.
 - a. Backbone Cable:
 - 1) Panduit Marker Tie (or approved equal)
 - b. Labelling shall comply with ANSI/TIA 606B and BICSI TDMM standards.

B. Hand-carried label maker:

- 1. Brady: ID Pro Plus (or approved equal).

PART 3 - EXECUTION

3.1 FIBER TERMINATION

- A. Fiber Optic Cable termination enclosures shall be placed at the top of the electronics rack, below the Upper Jumper Tray.
- B. Rack-mounted Un-interruptible Power Systems (UPS) shall be mounted at the bottom of the rack that will house the network equipment and other electronics.

- C. Cords for electrical service shall be separated from NIO station cables, and not be routed through station cable wire management devices.

3.2 SERVICE ENTRANCE FIBER OPTIC CABLES

- A. All Fiber Optic Cable shall have the full manufacturer Warranty.
- B. All Service Entrance Fiber Optic Cable shall be 12 Strand increments Single Mode of a continuous length and shall not exceed 9,840 LF without prior approval of the owner.
- C. Each entrance fiber cable shall have a minimum of 15 feet of maintenance loop coil at each end that shall be properly labeled and attached to or above the BET backboard, in an unused location, and above the plane of the wire-way or tray system.
- D. Entrance fiber shall be routed through 1-1/4 inch conduit or larger, to the BET, from the point of intersection with the tunnel tray system.
- E. All entrance fiber pathway conduits and pull boxes shall be labeled at terminus and all intersections.
- F. Each fiber cable label shall contain the fiber's source and destination.

3.3 CONNECTORS

- A. Fiber Connectors: Provide connectors and adapters per manufacturer recommendations and install into Connector Panels.

3.4 TESTING

- A. Provide test records on a form approved by the Owner and Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Designer for review and acceptance within two weeks of Substantial Completion.
 - 1. Print test records for each cable within the system directly from the tester and submit in paper form (in a binder) and in electronic PDF format (on flash drive or CDROM) to the Owner and Designer for review. Handwritten test results will not be accepted.
- B. Test the SCS after installation for compliance to all applicable standards as follows:
 - 1. Fiber: Test fiber optic cable on the reel upon delivery to the job site prior to installation, and again after installation.
 - a. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:
 - 1) Horizontal Distribution:

- a) Max Loss = 2.0db (per ANSI/TIA/EIA 568-B)
- 2) Backbone Distribution:
 - a) Max Loss = [(allowable loss/km) * (km of fiber)] + [(0.3db) * (# of connectors)]
 - b) A mated connector to connector interface is defined as a single connector for the purposes of the above formula.
 - c) A given fiber strand shall not exceed its calculated maximum loss (per the above formula).
- b. Test all strands using a bi-directional end-to-end optical transmission loss test instrument (such as an OTDR) trace performed per ANSI/TIA/EIA 455-61 or a bi-directional end-to end power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-B. Test the polarity of each pair of strands. Record the following measurements: length and attenuation.
 - 1) Calculate attenuation loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.
 - 2) Provide test measurements as follows:
 - a) Multimode Cable: Test at both 850 and 1300nm.
 - b) Singlemode Cable: Test at both 1310 and 1550nm.
- c. Test results shall conform to:
 - 1) The criteria specified in ANSI/TIA/EIA-568B.
 - 2) The Contractor's calculated loss budget above.
 - 3) The criteria specified in IEEE 802.3ae-2002 (10GBase-X 10 Gigabit Ethernet).
 - a) In addition to the above, perform tests both recommended and mandated by Corning. Tests shall confirm/guarantee compliance to Corning's performance standards and also IEEE 802.3ae-2002 for a maximum end-to-end dB loss of 2.5 dB.
 - 4) The criteria specified in IEEE 802.3ae-2002 (10GBase-X 10 Gigabit Ethernet).
- C. Identify cables and equipment that do not pass to the Owner and Designer. Determine the source of the non-compliance and replace or correct the cable or the connection materials. Retest the cable or connection materials at no additional expense to the Owner. Provide a complete revised set of all test results to the Owner and Designer, in the same manner as above. Remove original individual cable test reports that are unacceptable and insert the new corrected cable test reports. Do not simply resubmit the test reports for the corrected cabling only.
 - 1. In addition to the above, if it is determined that the cable is faulty, remove the damaged cable and replace it with a new cable. Cable repairs are not acceptable. The procedure for removing the cable shall be as follows:
 - a. Prior to removal of damaged cable and installation of new cable:

- 1) Inform the Owner and Designer of the schedule for the removal and installation.
 - 2) Test the new cable on the reel per paragraph B, above.
 - 3) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
- b. Remove the damaged cable and provide new cable.
 - c. After the removal of the damaged cable and installation of the new cable:
 - 1) Test the new cable per the paragraph titled TESTING.
 - 2) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.
 - d. If any of the cables requiring testing are in use, coordinate with the Owner to schedule an outage opportunity during which the testing can be performed.
 - e. If a cable which occupies the same innerduct or conduit (if not in innerduct) as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.
 - 1) Damaged cables which are replaced shall be subject to the testing procedures of the paragraph titled TESTING.

3.5 CLOSE-OUT

- A. Furnish uninstalled fiber optic cable reel remnants to the Owner.

END OF SECTION 27 1300

SECTION 27 1500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor for the installation of an inside plant telecommunication system. This section includes Inside Plant Communications cabling, termination, and administration equipment and installation requirements for the specified Structured Cabling System.

1.2 SYSTEM DESCRIPTION

- A. Provide and install all horizontal copper cabling and components as indicated within the drawing set and these specifications. Components required but not specifically identified shall be provided to ensure a complete and functioning system.
- B. All work shall be completed in accordance with ANSI/EIA/TIA and BICSI standards.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pathways shall be provided in accordance with specification sections 260530 "Conduit", 270529 "Hangers and Supports for Communications Systems", 270533 "Conduits and Backboxes for Communications Systems", and 270536 "Cable Tray for Communications Circuits."
- B. Telecommunications cabling system components such as cable, jack, and patch panels shall be of one manufacturer or product line.
- C. All copper cabling and components shall be manufactured by CommScope, Leviton, OCC or equal, unless specifically noted otherwise.

2.2 PATCH PANELS

- A. Copper Patch Panels
 - 1. Copper patch panels shall meet or exceed category 6 transmission requirements.
 - 2. Patch panels for horizontal copper station cables shall be modular jack panels with 8-pin RJ-45 modular jacks on the front face and insulation displacement terminal on blocks on the back.
 - 3. Provide sufficient patch panels in 24-port configurations, as required to terminate all horizontal station cabling to all communications outlets.
 - 4. Designation strips for each jack shall be provided on the patch panel. All cables shall be terminated in numerical sequence and labeled as to outlet number and jack position (A,

B, C, D). Designation strips shall be color-coded to separately identify the jacks located together at the same outlet.

5. Provide 2U of cable management for every 2U of horizontal patching.

2.3 CONNECTORS

- A. Copper Connectors (modular jacks): 8-position/8-conductor, insulation displacement connection (IDC), non-keyed, and shall accept modular 8-position/8-conductor plugs, complete with multicolored identification labels/icons for identification, and with a universally color-coded wiring pattern for both T568A and T568B.

1. Copper connectors shall meet or exceed category 6 transmission requirements.
2. Coordinate with owner for connector colors prior to ordering.

2.4 STATIONS

- A. Faceplates: Complete with port identification labels and blank inserts/fillers for covering unused connector openings:

1. Stations to be used for VOIP wall-mount telephones: Brushed stainless steel with stainless steel mounting lugs suitable for supporting wall-mount telephones:
2. All other stations shall be single-gang standard 1,2 or 4-port faceplates:
 - a. Verify color and finish with owner prior to ordering.
3. All stations without cabling shall be single-gang standard blank faceplates.

2.5 CABLE

- A. All telephone and data cable shall be suitable for power-limited communications use.
- B. Cable shall have a voltage rating of 300 volts minimum, and an operating temperature rating of 60°C minimum. Cable shall be "plenum-rated".
- C. All Station Cable shall have insulated, solid-copper conductors with an overall cable jacket and shall be 4-pair twisted #23 AWG.
- D. All Station Cable shall be UL verified and complying with Category 6 requirements contained in EIA/TIA Standard 568A.

2.6 LABELING AND ADMINISTRATION

- A. Labels:
 1. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, self-laminating vinyl, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

- a. Copper Cables:
 - 1) Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)
 - b. Labeling shall comply with ANSI/TIA 606B and BICSI TDMM standards.
- B. Hand-carried label maker:
- 1. Brady: ID Pro Plus (or approved equal).

PART 3 - EXECUTION

3.1 PATCH PANELS

- A. Provide patch panels and horizontal wire management according to locations, elevations, and plan views as shown on the Contract Documents.
- 1. Copper: Size and install rack-mountable patch panels as shown on the Contract Documents. Use patch panels to terminate copper horizontal cables. Do not exceed ten 2U-sized patch panels per rack.
 - 2. Fiber Optic: Terminate horizontal fiber optic cabling from all floors in the backbone fiber optic patch panel in the MDF.
 - 3. Horizontal Wire Management: Provide horizontal wire management as shown on the Drawings.

3.2 CONNECTORS

- A. Copper Connectors (modular jacks):
- 1. Provide connectors and install using T568A wiring pattern.
 - 2. Mount connectors at 90-degrees (i.e. straight, not angled)
 - 3. Punch down cable using only the selected SCS Manufacturer approved tool, achieving a fully repeatable, self-centering, non-impact mechanical termination process.
 - 4. Provide bend-limiting strain relief caps on both ends of cable.

3.3 STATIONS

- A. Faceplates: Provide faceplates for stations in the locations and gang counts shown on the Contract Documents.
- 1. Faceplates shall completely conceal outlet boxes, reducer plates, etc.
 - 2. Faceplates shall provide a snug and sure fit for connectors – loose connectors are not acceptable. Do not over-tighten faceplates such that warping occurs.
 - 3. Provide screws of sufficient length for each application.
- B. Flush-mount connectors in faceplates.

- C. Surface Device Boxes: Provide surface mount device boxes as required and as shown for surface mounted communications outlets.

3.4 CABLE

- A. General (applicable to all cable types): Provide plenum (CMP, OFNP) rated cable for all horizontal applications. Cabling shall bear plenum markings.
 - 1. Provide cabling in types, sizes, and quantities as defined by the Symbol Schedule and as shown on the Contract Documents. Install cable between the station and its associated telecommunications room. Provide one cable per each connector at each station. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.
 - 2. Install cable in compliance with ANSI/TIA/EIA and ISO/IEC 11801 requirements and BICSI TCIM practices.
 - 3. Inspect cabling and termination materials prior to installation. Verify that quality, condition, and product is as specified. Do not install materials that do not meet the specified requirements.
 - 4. Adhere to the bending radius and pull strength requirements as detailed in the ANSI/TIA/EIA standards and the manufacturer's installation recommendations during cable handling and installation.
 - a. The minimum bend radius shall be 10x the outside diameter of the cable.
 - b. The pulling tension shall not exceed 25 pounds per cable.
 - c. Pull all cables simultaneously where more than one cable is being installed in the same raceway.
 - d. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).
 - e. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cabling installation.
 - 5. Install cable in a continuous (non-spliced) manner unless otherwise indicated.
 - 6. Minimize the length of exposed (unjacketed) cable pairs, not to exceed ½ inch.
 - 7. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.
 - 8. Tie or clamp cabling. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable. Cables shall not rest upon acoustic ceiling grids or panels. Install tie-wraps in conformance with the SCS manufacturer's installation recommendations. Do not over-tighten tie wraps or cause cross-sectional deformation of cabling.
 - 9. Cabling in conduits:
 - a. Where multiple conduits or sleeves are used to carry cabling, fill conduits completely (per fill-ratio requirements) prior to using the next adjacent available conduit. Do not partially fill multiple conduits (and thereby waste space in a conduit) when it would be possible to completely fill that conduit.
 - 10. Cabling in cable trays:

- a. Do not bundle cables together.
 - b. During installation, temporarily install hook-and-loop straps (similar to Velcro) to hold cables in place near outside edges of cable tray around corners. After terminating the cables, remove the straps.
- 11. Cabling at backboards:
 - a. Lay and dress cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.
 - b. Route cable as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
 - c. Do not use D-rings to route horizontal cabling. Instead, use vertical ladder racking (securing cabling with hook-and-loop straps) and horizontal ladder racking, using the most direct route to the termination point. Route via a path that will minimize obstruction to future installation of equipment, backboards or other cables.
- 12. Cabling in telecommunications rooms:
 - a. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals with tie-wraps or hook-and-loop straps.
- 13. Cabling terminating on patch panels located on racks:
 - a. Route cables in telecommunications rooms to patch panels on racks by routing across ladder rack across top of rack and then down vertical ladder rack to patch panel.
 - b. Wherever possible, terminate cables consecutively according to their far-end termination in intuitively occurring groups (jacks in an outlet, outlets in a room, etc.).
- B. Copper Cable: Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.
 - 1. Provide station cable in the locations shown on the Contract Documents. Provide service loops for each outlet (minimum length of 18 inches) stored in the cable tray near the conduit serving the outlet. Provide service loops in telecommunications rooms (minimum length of 10 feet).
 - a. For copper station cabling installed in wet areas, including floor boxes in slab-on-grade applications, use outdoor-rated CAT6 cabling.
 - b. Route station cable that is exposed (not in conduit) to comply with ANSI/TIA/EIA-569 requirements for avoiding potential EMI sources and as follows:
 - 1) 48 inches from motors or transformers
 - 2) 12 inches from conduit and cables used for electrical power distribution
 - 3) 5 inches from fluorescent lighting
 - c. Cabling shall not share raceway with electrical power circuits, except for specifically designed system furniture raceways.

- C. Provide hook-and-loop cable managers for managing horizontal cabling in the telecommunications rooms. Cable managers shall be black colored.
 - 1. Cut hook-and-loop cable managers to length, such that the cable bundle is encircled with a 50% overlap.
 - 2. Cables shall be independently supported, not attached to other existing conduit, piping or equipment.
 - 3. Zip ties are prohibited.

3.5 TESTING

- A. Provide test records on a form approved by the Owner and Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Designer for review and acceptance within two weeks of Substantial Completion.
 - 1. Print test records for each cable within the system directly from the tester and submit in paper form (in a binder) and in electronic PDF format (on flash drive or CDROM) to the Owner and Designer for review. Handwritten test results will not be accepted.
- B. Test the SCS after installation for compliance to all applicable standards as follows:
 - 1. Copper:
 - a. Horizontal Distribution: Test all pairs of each copper station cable, in accordance with the field test specifications defined in ANSI/TIA/EIA 568-B Category 6, and ANSI/TIA/EIA 568B standards and ANSI/TIA/EIA-568-C.2. This document will be referred to as the Category 6 Standard. The test equipment shall comply with the accuracy requirements for the level III field testers as defined in the TIA Cat 6 Document. To the extent possible, perform tests with building electrical systems fully powered on (i.e. Lights, HVAC, etc.).
 - 1) Test each end-to-end link (the entire channel from the connector at the station to the connector or termination in the telecommunications room) utilizing sweep tests, for continuity, shield continuity, shorts, polarity, attenuation, installed length, transposition (wire map), mutual capacitance, characteristic impedance, resistance, ACR, Insertion Loss, Pair-to-Pair Near End Crosstalk (NEXT), Power Sum Near End Crosstalk (PSNEXT), Equal Level Far End Crosstalk (ELFEXT), Power Sum Equal Level Far End Crosstalk (PSELFEXT), Return Loss, and presence of AC voltage. Test each cable in both directions.
 - 2) Use a TIA/EIA Level III or higher accuracy level testing instrument, re-calibrated within the manufacturer's recommended calibration period or within one year (whichever is more recent), with the most current software revision based upon the most current ANSI/TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.

- a) Testing Device: Fluke DTX-1800, Micro-Test, Wirescope or Data Com Technologies, with latest software and hardware releases for TE CAT-6 horizontal distribution cables, or approved equal.
- C. Identify cables and equipment that do not pass to the Owner and Designer. Determine the source of the non-compliance and replace or correct the cable or the connection materials. Retest the cable or connection materials at no additional expense to the Owner. Provide a complete revised set of all test results to the Owner and Designer, in the same manner as above. Remove original individual cable test reports that are unacceptable and insert the new corrected cable test reports. Do not simply resubmit the test reports for the corrected cabling only.
- 1. In addition to the above, if it is determined that the cable is faulty, remove the damaged cable and replace it with a new cable. Cable repairs are not acceptable. The procedure for removing the cable shall be as follows:
 - a. Prior to removal of damaged cable and installation of new cable:
 - 1) Inform the Owner and Designer of the schedule for the removal and installation.
 - 2) Test the new cable on the reel per paragraph B, above.
 - 3) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
 - b. Remove the damaged cable and provide new cable.
 - c. After the removal of the damaged cable and installation of the new cable:
 - 1) Test the new cable per the paragraph titled TESTING.
 - 2) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.
 - a) If any of the cables requiring testing are in use, coordinate with the Owner to schedule an outage opportunity during which the testing can be performed.
 - d. If a cable which occupies the same innerduct or conduit (if not in innerduct) as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.
 - 1) Damaged cables which are replaced shall be subject to the testing procedures of the paragraph titled TESTING.

END OF SECTION 27 1500

SECTION 27 1523 - COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor for the installation of an inside plant Gigabit Passive Optical Network (GPON). This section includes Inside Plant Communications cabling, termination, and administration equipment and installation requirements for the specified Passive Optical Network as well as the required electronics.

1.2 SYSTEM DESCRIPTION

- A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete ANSI/TIA/EIA, NECA/NEIS and ISO/IEC compliant communications Gigabit Passive Optical Network as hereinafter specified and/or shown on the Contract Documents. The system is intended to be capable of integrating voice, data, and video signals onto a common medium, and shall be tested for and be capable of 1 Gigabit Ethernet operation as specified in TIA/EIA 568-B.2-10 and ISO/IEC 11801:2002/Amd 1:2008.
- B. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary for a complete working ANSI/TIA/EIA and ISO/IEC compliant GPON.

PART 2 - PRODUCTS

2.1 GENERAL

- A. GPON components shall be manufactured by the manufacturers listed below. Components shall not be intermixed between different manufacturers unless the manufacturer of the GPON has listed (in writing) another manufacturer's component as an "Approved Alternative Product" and will warrant the "Approved Alternative Product" as part of the GPON Manufacturer Warranty (see Section 270500 — "Common Works Results for Communications" PART 1 – WARRANTY).
 - 1. Bid only the following GPON Manufacturers and only bid manufacturers for which the Contractor is certified. Substitution is not acceptable. The GPON Manufacturers shall be the following:
 - a. Tellabs
- B. All fiber optic-related components shall be part of the fiber optic GPON product line – components shall not be intermixed between manufacturers' GPON product lines. The GPON product lines shall be engineered "end-to-end" – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

- C. All passive GPON cabling and components shall be manufactured by Corning, Commscope, OCC or equal, unless specifically noted otherwise.

2.2 FIBER OPTIC PATCH PANELS

- A. The Contractor shall Provide and Install Fiber Optic Cable Termination enclosures and Closet Management Panels for this building. The enclosures shall be equal to Corning/LAN- scape, CCH-04U, rack-mounted distribution panel, shall be mounted immediately below the Closet Jumper Management Panel (CJP-01U), and shall use the following connectors:
 - 1. SC Bulkhead Connectors for single-mode fiber strands (station cabling only) shall be SC/APC duplex ceramic inserts with composite housing equal to Corning CCH-CP12-6C.

2.3 FIBER OPTIC SPLITTERS

- A. Fiber Optic Splitters shall be supplied with the required quantity of Fiber Management Frames and Fiber Optic Splitter Modules as indicated on the drawings.
- B. Fiber Management Frame
 - 1. Corning/LAN-scape CCH-04U or equal
- C. Fiber Optic Splitter Module
 - 1. 2x32 WDCM SC/APC splitter Conring/LAN-scape CCH-UMB-6CD6CE1232 or equal

2.4 FIBER OPTIC CONNECTORS

- A. Fiber Optic Couplers (modular jacks) shall be compatible with snap in faceplates specified in section 271500.
 - 1. SC Simplex Coupler, APC, Green: Corning 728-7110-0330B or equal

2.5 FIBER OPTIC CABLE

- A. General: Cables shall be manufactured by the selected SCS Manufacturer. All cables shall be plenum rated.
- B. Fiber Cable:
 - 1. Fiber cables shall be Singlemode 8.3/125 μ m OS2, factory-terminated, 3mm yellow jacket, and shall permit a bend radius of 7.5mm without changing cable characteristics. Cable shall be manufactured by the selected SCS Manufacturer and shall be:
 - a. SC APC to SC APC, plenum-rated, Ivory drop cable

2. For wet environments, fiber cables shall meet the performance and behavioral characteristics described above, be rated for indoor/outdoor use, and be plenum-rated where required.

2.6 INNERDUCT

- A. Intra-building innerduct shall be 1 inch size, orange, unsplit, corrugated, with pull tape:
 1. Plenum-rated: Carlon or approved equal
 2. Riser-rated: Carlon or approved equal

2.7 ELECTRONICS

- A. Optical Network Terminals (ONT) shall be:
 1. Tellabs ONT140W 4-port in wall ONT.
 2. Tellabs ONT205 4-port surface mount ONT.
 3. Tellabs ONT180C 8-port surface mount ONT.
 4. Tellabs ONT248 48-port rack mounted ONT.
- B. Optical Line Terminals (OLT) shall be:
 1. Tellabs FlexSym OLT1 with:
 - a. Uplink SFP 10G MM LC C.11T-X0192SR1851M
 - b. GPON SFP 81.11T-XFPGON-IT
 - c. OLT power supply
 - d. Advance operations software package FlexSym OLT1
 - e. 1-year 24x7 TAC licensing (support, hardware repair, advanced replacement and software upgrades)

2.8 LABELING AND ADMINISTRATION

- A. Labels:
 1. As recommended in ANSI/TIA/EIA 606. Labels shall be permanently inscribed (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.
 - a. For Station Cable:
 - 1) Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)
 - b. Labeling shall comply with ANSI/TIA 606B and BICSI TDMM standards.
- B. Hand-carried label maker:
 1. Brady: ID Pro Plus (or approved equal).

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide a complete functioning GPON infrastructure, including all required components.

3.2 FIBER PATCH PANELS

- A. Provide patch panels and horizontal wire management according to locations, elevations, and plan views as shown on the Contract Documents.
 - 1. Fiber Optic: Terminate horizontal fiber optic cabling from all floors on horizontal fiber optic patch panels in the main telecommunications room (MDF).
 - 2. Horizontal Wire Management: Provide horizontal wire management as shown on the Contract Documents.

3.3 FIBER DISTRIBUTION TERMINALS

- A. Provide fiber distribution terminals according to locations, elevations, and plan views as shown on the Contract Documents.

3.4 FIBER SPLITTERS

- A. Provide fiber splitters as shown on the Contract Documents.

3.5 FIBER OPTIC CONNECTORS

- A. Provide fiber optic couplers for each outlet as shown on the Contract Documents.

3.6 STATIONS

- A. Provide outlets, faceplates, fiber terminations, and ONT devices for each endpoint application as shown on the Contract Documents.

3.7 FIBER OPTIC CABLE

- A. General (applicable to all cable types): Provide non-plenum (CM/CMR, OFNR) rated cable for locations where cable is to be installed in conduit. For cable not installed in conduit, provide plenum (CMP, OFNP) rated cable if cable is installed in a plenum air space environment. Otherwise, provide nonplenum-rated(CMR) cabling. Cabling shall bear plenum or non-plenum markings for the environment in which it is installed.
 - 1. Horizontal Distribution: Provide station cable in types, sizes, and quantities as defined by the Symbol Schedule and as shown on the Contract Documents. Install cable between the station and its associated telecommunications room. Provide one cable per each

- connector at each station. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.
2. Install cable in compliance with ANSI/TIA/EIA and ISO/IEC 11801 requirements and BICSI TCIM practices.
 3. Adhere to the bending radius and pull strength requirements as detailed in the ANSI/TIA/EIA standards and the manufacturer's installation recommendations during cable handling and installation.
 - a. Pull all cables simultaneously where more than one cable is being installed in the same raceway.
 - b. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).
 - c. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cabling installation.
 4. Install cable in a continuous (non-spliced) manner unless otherwise indicated.
 5. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.
 6. Tie or clamp cabling. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable. Install tie-wraps in conformance with the GPON manufacturer's installation recommendations. Do not over-tighten tie wraps or cause cross sectional deformation of cabling.
 7. Cable at the backboards:
 - a. Lay and dress cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.
 - b. Route cable as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
 - c. Do not use D-rings to route horizontal GPON cabling. Instead, use vertical ladder racking (securing cabling with hook-and-loop straps) and horizontal ladder racking, using the most direct route to the termination point. Route via a path that will minimize obstruction to future installation of equipment, backboards or other cables.
 8. Cable in the telecommunications rooms:
 - a. For telecommunications rooms with ladder racking, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals with hook-and-loop straps.
 9. Cable terminating on patch panels located on racks:
 - a. Route cables in telecommunications rooms to patch panels on racks by routing across ladder rack across top of rack and then down vertical ladder rack to patch panel.

B. Fiber Optic Cable:

1. Provide station cable in the locations shown on the Contract Documents. Provide service loops with a minimum length of 12 inches in outlet boxes and no less than 10 feet in the ER/TR's. Store the remainder of the slack using manufacturer-recommended solutions (reels, cartridges, etc.).
 - a. For workstation outlets with both fiber and copper cabling, terminate fiber optic cabling after copper cabling has been installed and terminated.
 - b. For fiber optic station cabling installed in wet areas, including floor boxes in slab-on-grade applications, use Indoor/Outdoor Wet Environment-rated cabling.
2. Innerduct
 - a. The Designer shall indicate in the Contract Documents where innerduct is required, consistent with the requirements described below.
 - b. Innerduct is required for routing horizontal GPON fiber optic cabling through all vertical riser pathways (conduits and sleeves) that exceed 4 feet in length.
 - c. Innerduct is also required for routing horizontal GPON fiber optic cabling through cable trays where larger outside plant cable shares the cable tray.
 - d. Otherwise, innerduct is not required for routing horizontal GPON fiber optic cabling.
 - e. Where innerduct is required, install fiber optic cable in innerduct per manufacturer's instructions. Innerduct shall terminate within 6 inches of top of each patch panel where fiber optic cable terminates. Secure innerduct with zip-ties at intervals not exceeding 24 inches. Do not use wire or tape.
 - f. See Sections 271300 and 338200 for innerduct requirements related to fiber optic backbone cabling in inside plant and outside plant backbone applications, respectively.

3.8 TESTING

- A. Provide test records on a form approved by the Owner and Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Designer for review and acceptance within two weeks of Substantial Completion.
 1. Print test records for each cable within the system directly from the tester to an Adobe Acrobat PDF file, and submit only in electronic form (on CDROM or DVDROM) to the Owner and Designer for review. Handwritten test results will not be accepted.
- B. Test the GPON after installation for compliance to all applicable standards as follows:
 1. Fiber Optic:
 - a. Horizontal Distribution: Test all strands following the procedure in Section 271300 – "Communications Backbone Cabling".
- C. Identify cables and equipment that do not pass to the Owner and Designer. Determine the source of the non-compliance and replace or correct the cable or the connection materials. Retest the cable or connection materials at no additional expense to the Owner. Provide a

complete revised set of all test results to the Owner and Designer, in the same manner as above. Remove original individual cable test reports that are unacceptable and insert the new corrected cable test reports. Do not simply resubmit the test reports for the corrected cabling only.

1. In addition to the above, if it is determined that the cable is faulty, remove the damaged cable and replace it with a new cable. Cable repairs are not acceptable. The procedure for removing the cable shall be as follows:
 - a. Prior to removal of damaged cable and installation of new cable:
 - 1) Inform the Owner and Designer of the schedule for the removal and installation.
 - 2) Test the new cable on the reel per paragraph B, above.
 - 3) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
 - b. Remove the damaged cable and provide new cable.
 - c. After the removal of the damaged cable and installation of the new cable:
 - 1) Test the new cable per the paragraph titled TESTING.
 - 2) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.
 - a) If any of the cables requiring testing are in use, coordinate with the Owner to schedule an outage opportunity during which the testing can be performed.
 - d. If a cable which occupies the same innerduct or conduit (if not in innerduct) as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.
 - 1) Damaged cables which are replaced shall be subject to the testing procedures of the paragraph titled TESTING.

END OF SECTION 27 1523

SECTION 27 4116.10 - AUDIO-VISUAL SYSTEMS BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Section 274116.10: Audio-Video Equipment List applies to this Section.

1.2 SUMMARY

- A. This section contains the general requirements for basic materials and installation methods that apply to Audio-Video Sections of Division 27. Materials and equipment shall be installed in conformance with the manufacturer's installation instructions and U.L. requirements.
- B. The work of this Section and related sections is shown in the narrative specifications section and equipment lists.

1.3 BID ALTERNATES

- A. Base Bid includes all work shown on the AV drawings and specified in Division 27.

1.4 APPROVED EQUIPMENT AND SUPPLIER

- A. Equipment will be the specified products or approved substitutions per 01 6030.
- B. The systems provider shall be an authorized factory representative of the specified equipment to ensure proper specification adherence for system programming, operation, final connection, test, turnover, warranty compliance and aftermarket service.
- C. System and all appurtenances shall be manufactured, tested and shipped by a single supplier that can provide 24 hour service with factory trained personnel, a required stock of replacement parts, and technical assistance.
- D. The Audio-Visual plans and specifications were prepared by:
Dimensional Communications

1220 Anderson Road

Mount Vernon, WA 98274

Contact Avery Dahl (360) 424-6164

PART 2 - PRODUCTS

2.1 GENERAL

- A. Equipment shall be new, unused, and undamaged.
- B. Materials shall be new, free from defects and not less than the quality herein specified. Materials shall be designed to insure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.
- C. Where these specifications include model or series numbers, the provided equipment (including substitutions) shall meet or exceed the manufacturer's published specifications for the specified model or series the same as if the manufacturer's published specifications were enumerated within these project specifications. This requirement is in addition to the other requirements given in the project specifications. This requirement is not intended to apply to characteristics (such as color or appearance) which do not affect the performance, function, or reliability.
- D. Prior to ordering equipment, the Contractor shall coordinate the frequencies of all new and existing wireless devices in the facility to prevent unwanted interaction between devices and rooms. This includes, but is not limited to wireless microphones, assisted listening system devices, wireless control panels, etc.

- E. Accessories, including rack mounting hardware, power supplies, etc., shall be obtained from the original equipment manufacturer. Unless otherwise noted or specified, third party accessories shall not be used.
 - F. Equality
 - 1. Other products of equal quality and function may be furnished, subject to approval by the Owner, Architect, and Consultant.
 - 2. Proof of equality rests with the submitter. The Owner shall be the final judge of equality.
 - G. Owner Furnished Equipment
 - 1. See equipment list
 - H. Manufacturer:
 - 1. Do not provide an assortment. For each category, provide products of the same manufacturer; for each item, provide the same model for all pieces.
 - I. Accessories:
 - 1. Any standard accessory or item supplied by the manufacturer as part of the system shall be turned over to the Owner as a loose item at the time of project acceptance.
- 2.2 COMPLETE SYSTEMS
- A. The systems mentioned shall be complete in every detail and fully operational upon completion of the project unless specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide complete and fully operational systems.
 - B. The systems integrator will be responsible for determining the proper equipment compliment to provide complete and working systems, based on the operational requirements set forth in the specification.
- 2.3 EQUIPMENT LIST
- A. Major product types and quantities are listed in Section 274116.10 Audio-Video Equipment List.
- 2.4 PHYSICAL INSTALLATION
- A. The equipment in this area shall be as detailed on drawings.
 - B. Equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
 - C. Equipment shall have an engraved plaque permanently affixed, denoting its function.
 - D. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. Boxes, equipment, etc., shall be secured plumb and square.
 - E. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

- F. Equipment requiring power (such as line drivers) located in AV outlet boxes, shall be installed so that power is fed remotely from the main equipment location (i.e. AV Rack). Under no circumstances shall a remote device be powered from an adjacent receptacle unless permission has been granted by the Owner's Representative.

2.5 EQUIPMENT RACKS

- 1. See equipment list.
- B. Provide hardware as required for standard 19" rack mounting of equipment.
 - 1. Items that do not include manufacturer-provided rack hardware shall utilize a factory-made clamping rack-mount kit such as the RC or CAP series manufactured by Middle Atlantic Products.
 - 2. There shall not be any unsecured shelf-mounted components in the audiovisual racks.
- C. Provide blank or vented inserts as required to fill all rack spaces.
 - 1. Provide a minimum of 1 rack unit of vented space at top and bottom of rack.
 - 2. Provide rack blanks for all non-used rack spaces. In enclosed spaces provide vented rack blanks to support air circulation in place of solid blanks.

2.6 INPUT/OUTPUT OUTLET BOX PLATES

- A. Provide custom anodized black aluminum outlet plates for all boxes where connections are shown on the drawings. Label connections by laser engraving text into the anodization.
- B. For boxes shown with no connections, provide a metal plate with hole and grommet for the cables to pass through.

2.7 POWER STRIPS/MULTI-OUTLET ASSEMBLIES

- A. Provide switchable plug strips or multi-outlet assemblies as required to connect AC power to all associated equipment in racks, equipment consoles and custom mounting enclosures. Provide a minimum of one plug strip or multi-outlet assembly per rack and per power circuit.
- B. Where applicable use rack manufacturer part or plug strip kit.

2.8 CABLE

- A. Provide wire and cables which are UL-listed and marked for their Class of wiring, per NEC.
- B. Trade numbers shown below are for general-purpose cables for use in raceway and where otherwise allowed by NEC and other codes. Prior to installation, the Contractor shall verify, for each installation situation, with the local authority having jurisdiction that non-plenum and non-riser rated cables are acceptable. In the event that plenum or riser-rated cables are required, provide cables so rated with equivalent electrical characteristics to those specified below.
- C. Video cable for runs greater than 100 feet shall be Belden 1694A (Non-Plenum), Belden 1695A (Plenum), or approved equivalent. Bundled versions of the above cables are acceptable.
- D. Video cable for runs of less than 100 feet shall be Belden 1694N 1695A or 1505A (Non-Plenum), Belden 1506A (Plenum), or approved equivalents. Bundled versions of the above cables are acceptable.
- E. RF 50 ohm microphone antenna cable shall be Belden 9913 (Non-Plenum) or Belden 89913 (Plenum), or approved equivalent.

- F. Video over UTP cable shall Crestron DM-CBL-8G-NP (Non-Plenum) or Crestron DM-CBL-8G-P (Plenum), or approved equivalent.
- G. Audio cable shall be Belden 9451 (Non-Plenum), Belden 9451P (Plenum), or approved equivalent.
- H. Speaker cable for 70-volt lines shall be Belden 5300UE (Non-Plenum), Belden 6300UE (Plenum), or approved equivalent.
- I. Speaker cable for 4, 8, or 16 ohm circuits shall be Belden 5000UE (Non-Plenum), Belden 6000UE (Plenum), or approved equivalent.
- J. Cat5E cable for control and network shall be Belden 1583 (Non-Plenum), Belden 1583P (Plenum), or approved equivalent.
- K. Provide multi-conductor control cable with wire size and number of conductors as recommended by the manufacturer and as required for the distance of run and required functions, for remote controlled devices.
- L. Control cable shall be shielded with color coded conductors, except where other types are specifically recommended by the manufacturer as the optimal type.
- M. Color-coding shall conform to the NEC color coding standard for all multi pin connector wiring.
- N. Cable substitutions from Liberty, Gepco, West Penn, Commscope, and equivalent will be considered.

2.9 CONNECTORS

- A. Balanced audio connectors shall be 3-conductor, gold plated XLR type. Connector shell connection isolated. Neutrik equivalent.
- B. Unbalanced audio connectors for both RCA and 1/4" phone and balanced 1/4" phone shall have metal case and solder connections for connecting wire to plug contact type Neutrik equivalent.
- C. Coax cable connectors for video cables shall be true 75 ohm precision BNC connectors. ADC equivalent.
- D. RF coax connectors shall be LRC F56QX for RG-6 cables, LRC F59QS for RG-59 cables, and LRC F110S for RG-11 cables, or approved equivalents.
- E. RJ-45 data style connectors for nonpermanent installations shall have metal case with quick-lock release. Neutrik NE8 Series equivalent.

PART 3 - EXECUTION

3.1 CUTTING BUILDING CONSTRUCTION

- A. Obtain permission from the Architect or Owner and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.
- B. Construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.2 PENETRATIONS OF FIRE RATED ELEMENTS

- A. Must be provided such as to retain the fire rating.

3.3 PAINTING / FINISHES

- A. Verify connection faceplates, equipment, mount finishes outside equipment racks in public areas are acceptable and approved by the architect prior to purchase and installation.
- B. Painting will generally be provided by the General Contractor, except for refinishing of items furnished under this Division which are scratched or marred in shipment or installation.

3.4 CLEAN UP

- A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.
- B. Clean equipment to remove plaster, taping or patching compound, overspray, paint spills, oil, grease, dust, fingerprints, or other dirt or contaminants to restore equipment to original finish and condition.
- C. Remove dirt and debris from the interior of enclosures, outlet boxes, pull and junction boxes, and equipment cabinets.

3.5 WORKMANSHIP AND OBSERVATION

- A. Workmanship shall be of the best quality and none but competent and experienced AV Contractors shall be employed and shall be under the supervision of a competent and experienced foreman.
- B. Completed work shall represent a neat and orderly appearance.
- C. All work and materials shall be subject to observation at any and all times by representatives of the Architect and Consultant.
- D. The Contractor shall keep the job adequately staffed at all times including a designated field supervisor present at the job site, and in responsible charge during all phases of installation and checkout. This supervisor shall be the same individual throughout the execution of the work, unless illness, loss of personnel, or other circumstances beyond the control of the Contractor intervene.

3.6 INSTALLATION

- A. Verify performance of each and every item of equipment to be equal to or better than factory specifications. Repair or replace items or components that do not meet factory specifications.
- B. Boxes, equipment, etc. shall be plumb and square.
- C. Equipment (except portable equipment) shall be firmly held in place. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. Equipment shall be braced for seismic conditions according to applicable codes and regulations.
- D. All connectors on wall plates, or in other exposed locations, are to be recessed.

3.7 EQUIPMENT MOUNTING

- A. Loudspeakers:

1. Do not support speaker enclosures with lay-in tiles or GWB. Provide adequate support (using attachments to structural elements and/or metal mounting bars) for back-boxes so that no perceptible sag will occur once speaker and grille are mounted.
 2. Caulk enclosures to ceiling surface (e.g. lay-in tile or GWB) to form an airtight seal.
 3. Loosely fill metal speaker enclosures with unfaced, 0.75 lb/cu.ft, glass fiber batting.
 4. Verify polarity of each speaker voice coil prior to installation and connect to maintain uniform polarity.
 5. Tap 70 volt transformers as shown, or to provide an amplifier load between 60% and 90% of rated capacity with all speaker-line attenuators (if any) set for minimum attenuation.
 6. Install speaker and baffles to provide tight seal with ceiling and enclosure. Do not caulk baffle to ceiling.
 7. Install so speaker grille is centered in tile or building element, with sides of grille or line between mounting fasteners parallel to ceiling grid or building lines.
- B. Rack-mounted equipment:
1. Install vent panels between amplifiers if recommended by the manufacturer.
 2. Install blank panels to fill any unused rack spaces.
 3. Separate heat producing equipment by at least one rack unit and install blank(s) as required.
 4. Mount mixers, controls, and patch panels at working height.
 5. Within racks, install cables and wiring neatly, forming straight lines and smooth corners. Bundle separately, or install in separate plastic ducts, the microphone, line-level audio, speaker, control, video, and power wiring.
- C. Video Projector Mounts
1. Provide complete mounting assembly to attach projector assembly to ceiling structure.
 - a. AV Contractor is responsible for anchoring to concrete structure.
 2. If required, Contractor shall provide variations to detailed mounts to accommodate obstacles above ceiling. Contractor may have to trapeze around ducts, pipes, or other obstacles. Submit proposed mounting solution in these areas as part of shop drawings.
 3. Video projector mount shall not come in contact with any ceiling devices and must only be supported from building structure to minimize vibrations transferred to projector.
 4. Finish penetration through finished ceiling with Peerless ACC640 Escutcheon Ring or equivalent. Verify color with architect or paint as directed.
- D. Seismic Restraints:
1. All hanging or free standing equipment and cabinets provided under this contract shall be secured to substantial building structure to resist seismic acceleration in any direction up to 1.0G, or the limit proscribed by governing codes.
 2. AV equipment hanging details, rack bracing, and other seismic restraints are not shown on the contract documents. The Contractor is responsible for all seismic restraints.
 3. Seismic restraints shall not interfere with the maintenance or service of AV devices.
- E. Americans with Disabilities Act
1. Mount all equipment per ADA requirements.
- 3.8 WIRING
- A. To the greatest extent possible, install wire and cable only within the raceway systems being provided under Division 26. Do not install wire or cable in wall cavities or ceiling plenums/attic spaces without the use of raceway (conduit or cable tray), without the explicit written permission of the Owner's Representative, or as otherwise noted on the drawings.

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1. Wiring for loudspeakers may be installed with or without conduit/raceway.
Where installed without raceway, provide plenum-rated wiring where required.
- B. Maintain conduit fills equal to or less than those given by Table 1 of Chapter 9 of the NEC, regardless of the class of wiring.
- C. Cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cable families:
 1. Power cables
 2. Control cables
 3. Video cables
 4. Audio cables carrying signals less than -20 dBm
 5. Audio cables carrying signals between -20 dBm and +20 dBm
 6. Audio cables carrying signals above +20 dBm
- D. As a general practice, all power cables, control cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.
- E. Protect installed conductors from painting, overspray, and taping or patching compounds.
- F. Number or color code each cable. Number or color code individual conductors of cables to identify circuits and connections.
- G. Record number and color codes on the "RECORD SET" drawings.
- H. Cables ties shall be placed at appropriate intervals of no greater than six inches for vertical bundles, two inches for horizontal bundles.
- I. Do not use cable ties in the cable tray or overhead junction boxes.
- J. Cable assemblies shall utilize a service loop so that equipment in racks or equipment consoles can be fully pulled out for service without cutting wire ties or putting undue stress on cable assemblies.
- K. Cable assemblies run in conduit and/or cable trays should provide for a minimum of 3 feet of excess cable on each end to allow for relocation of equipment or re-termination of cable in the future.
- L. All vertical cable bundles shall be attached to the rack frame.
- M. Cables shall be continuous lengths without splices. All system wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. Except where noted otherwise in the specifications, NO BARE WIRE TERMINATIONS WILL BE ACCEPTED unless specifically directed by the manufacturer. Heat-shrink tubing shall be used to insulate the ground or drain wire. Unused wires at the end of a cable shall remain unstripped and shall be laid back and held in place with wire ties.
- N. Prior to connection, verify freedom from shorts or grounds of all conductors (including shields and drain wires) of all cables.
- O. Solder connections shall be made with rosin-core solder using temperature-controlled solder stations. Care shall be taken to avoid cold or cracked solder joints. Any connections which do not appear to be clean and shiny, or which show signs of cracking, shall be resoldered by the Contractor before final acceptance of the system.
- P. Connections made with screw actuated pressure type terminal strips shall be made by stripping approximately 1/4 inch of insulation from the stranded conductor. Then the un-

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tinned wire shall be inserted into the terminal and the screw tightened using a secure fitting precision screwdriver.

- Q. For all crimp-type connectors and pins, utilize only crimp tools rated for the crimp pin type, size and wire gage being assembled. Consult the manufacturer's specifications and recommendations for crimping.
- R. Utilize only gold-plated crimp pins.
- S. Cables shall have proper connector housing.
- T. Cables shall not protrude from the back of racks.
- U. Cable entry shall be through the tops of racks or through entrance holes in the base of the rack. No cable shall enter racks through front, rear or side panel openings.

3.9 WIRING NUMBERING

- A. Develop a wire numbering system to uniquely identify each AV cable and each AV cable's signal type.
- B. Identify each equipment location with an alpha-numeric identifier. Include room and rack or bay location.
- C. For each system, include the following on the wire run list, for each cable:
 - 1. Cable number
 - 2. Signal type
 - 3. Cable type
 - 4. "To" destination
 - 5. "From" destination
 - 6. Room and equipment location for both ends of the cable
 - 7. Approximate length of cable run
- D. Provide the cable numbering list as a computerized spreadsheet, in a format compatible with Microsoft Excel (version 2007 or higher). As part of the O&M Manuals, provide:
 - 1. Printed copies in each Manual.
 - 2. One set of electronic files, on CD-ROMs in a format compatible with IBM-PCs.

3.10 GROUNDING AND SHIELDING

- A. Rack Grounding
 - 1. Prior to installing or connecting equipment, temporarily disconnect ground wires from equipment cabinet(s), and measure impedance between each ground wire and its cabinet. Verify electrical isolation (minimum resistance of 1 mega-ohm) between rack cabinets and raceway and conductive structure. Record results for test report. Reconnect ground wires.
- B. Install a single-point grounding system for each system. Where multiple systems are installed in a single grouping of racks, they shall be considered one system for grounding purposes.
- C. Verify integrity of grounding systems and isolated receptacles prior to connection of equipment.
- D. Connect shield and grounding conductors as follows:
 - 1. Insulate shields from connector shell, plates, boxes, and raceway.
 - 2. Connect shields of wiring from patch panel to control console inputs only to control console (insulate at patch panel).
 - 3. Connect shields of balanced line level circuits at patch panel only; insulate at other end. For balanced circuits that do not terminate on patch panel, connect shields at input

ends only; insulate at output ends. Use this standard as needed to correct ground hum issues

- E. Maintain shield and drain wire continuity through junction boxes and intermediate termination points. Insulate shields from raceway or other conductive building elements. Maintain shields to within 3 inches of connected devices, and maintain twisting of pairs of wires to within 1/2 inch of connector or device termination.
- F. Make any modifications to grounding and shielding which are necessary to eliminate extraneous noise and RFI, prevent oscillations, parasitics, and other signal instabilities, and to meet overall systems noise specifications. Record any deviations from the above guidelines, and the reasons that each deviation was deemed necessary.
- G. Do not remove or defeat grounding terminal of 3 conductor power cords, and maintain safety grounding and bonding as required by the NEC.
- H. The overall governing requirements are that the wiring systems shall not induce or pick up perceptible noise, and that the predominant components of the noise floor of all signal paths shall be normal "thermal" noise of the upstream devices.
- I. Because of the great number of possible variations in grounding systems, it shall be the responsibility of the Contractor to follow manufacturer's guidelines and good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems.

3.11 CONNECTIONS

- A. Terminate unused RF tap, splitter, video outputs, and distribution amp ports with a 75 Ohm terminator.
- B. If a signal path requires that the signal pass through more than one device, each device must have looping input capability, or a distribution amplifier must be used to feed the signal to the devices. Do not use a video "T" in place of a video distribution amp to route signals to more than one device.
- C. All audio circuits shall be balanced (high, low, shield) except where otherwise indicated. Balance boxes shall be used to convert unbalanced equipment to balanced, where necessary to conform to a balanced standard.
- D. Wire all three and five pin audio connectors and quarter-inch phone jacks (mono and stereo) in accordance with IEC-268.
 - 1. For three pin connectors, Pin 1 is ground, Pin 2 is positive, and Pin 3 is negative.
 - 2. For five pin connectors, Pin 1 is ground, Pin 2 is left positive, Pin 3 is left negative, Pin 4 is right positive, and Pin 5 is right negative.
 - 3. For quarter-inch stereo phone jacks, tip is positive, ring is negative, and sleeve is ground.
 - 4. For quarter-inch mono phone jacks, tip is positive and sleeve is ground.
- E. Connections:
 - 1. Splice only in accessible junction boxes, using insulated crimp-on connectors, wire-nuts, or other methods approved by the Engineer. Do not splice in conduits or cable tray.
 - 2. Make connections to plugs, receptacles, connectors, or solder terminals using rosin-core solder. Make connections to screw connections using insulated spade lugs.
 - a. Ensure that no uninsulated wire is exposed beyond its pin.
 - b. Utilize only multi-core flux resin with 60/40 tin-lead non-corrosive construction, designed for electronic equipment use.

- c. Soldering shall utilize good engineering practices, and completed solder connections shall appear shiny and smooth with no visible imperfections or cold-solder joints.
- 3. Serve shielded cables with heat shrink tubing to insulate shield and drain wire.
- 4. Cable jacket shall be fully engaged by the strain relief of the connector.
- F. Patch Panel Assignments
 - 1. All patch panels shall be wired so that signal "sources" (outputs from) appear on the upper row of a row pair; and all "loads" (inputs to) appear on the lower row of a row pair.
 - 2. Patch Panel Designation Strips
 - a. All audio and video patch panel designation strips shall utilize alphanumeric identifications and descriptive information. The jack position in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the functional block drawings, as well as on reproductions of these drawings, which shall be mounted in an appropriate location near the patch bays.

3.12 LABELING

- A. Label cables on each end, with number and identification legend clearly identifying the connection point for the cable end. Labels shall be self-laminating type, such as Panduit PDL-54 or PDL-56. Labels shall be sized and placed so that they are clearly visible and readable after final installation and dressing.
 - 1. Do not place label closer than one (1) inch from cable end.
 - 2. [For patch bays to meet the above visibility and readability specification, do not place label closer than eight (8) inches from cable end.]
- B. Clearly label input and output jacks and receptacles with engraved lettering. Labeling will include type of receptacle (MIC, LINE, AUX) and input number. Use of lamacoid labels, press-on, or Kroy-style labels is not acceptable.
- C. Clearly label equipment to identify the equipment number and designator. Example: VG/VRGB/S interface number 5 shall be labeled "Interface 5". This label shall be visible on the front and back of each piece of equipment.
 - 1. Lettering should be of adequate size to be legible from a distance of at least 3 feet.
 - 2. Labels should be applied to equipment so that they can be removed without damaging the equipment but will remain intact under normal operation or servicing.
 - 3. Equipment labels shall be approved by the Owner prior to installation.

3.13 PERFORMANCE STANDARDS

- A. Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required under the Detailed Specifications, the following performance standards shall be met by each system:

1. Audio	
Frequency Response:	Within +/- 0.5dB from 20Hz to 20kHz
Signal to Noise Ratio (including crosstalk and hum at all input/output levels)	>90dB
Total Harmonic Distortion	0.05% maximum from 20Hz to 20kHz
<u>Input Levels</u>	
Microphone (Nominal)	-50dBu
Overload (Minimum gain)	-5dBu
Maximum Gain	-26dBu

Line (Nominal)	+4dBu
Overload (Minimum gain)	+24dBu
Maximum Gain	+9dBu
Input Common Mode Rejection	>100dB
<u>Output Levels</u>	
Line (Nominal)	+4dBu
Line (Maximum)	+24dBu
Output Impedance	<0.5 ohms
Load Impedance	>150 ohms
2. Video	
Frequency Response:	Flat from 30Hz to 6MHz, +/-2% (ref.=1MHz)
Signal to Noise Ratio (including crosstalk and hum at all input/output levels)	>60dB, p-p signal to RMS noise
Total Harmonic Distortion	0.05% maximum from 20Hz to 20kHz
Differential Gain	Less than 2%
Differential Phase	Less than 2 degrees at 3.58MHz
Tilt	Less than 2%
System Gain	Unity, +/- 1%
System Levels	Less than 2% between sources
Timing	Less than 20nS, Y/C, Y/Cr/Cb, RGB
Luminance	In conformance with NTSC RS-170A standards
Chroma Level	In conformance with NTSC RS-170A standards
Observable noise or hum	None
3. CATV/RF	
System Bandwidth	50MHz to 860MHz
Tilt	Less than 6dB
Minimum output level at tap	+3dB re: 1 microvolt
Maximum output level at tap	+12dB re: 1 microvolt
VSWR	1.4:1
Observable noise or hum	None
RF Radiation Levels	Meet all FCC requirements
4. Control Systems: The programming of the AV control system and/or touch panel layouts must be reviewed and approved by the Owner and Consultant. All graphic design, button functions, text feedback, page flips, and operational details shall be presented to the Owner and Consultant as concepts, not as a finalized designed product.	

3.14 TESTING

- A. Perform testing in accordance with other Sections of Division 27.
- B. Testing and adjustment of equipment shall be performed by qualified technicians with prior knowledge of the particular items of equipment, and general knowledge of video and audio systems alignment and trouble shooting and knowledge of the specific systems and installations of this project.
- C. All manufacturers' maintenance or alignment manuals shall be present during testing and adjustment procedures.
- D. Measurements and Performance Testing

1. Video:
 - a. Verify that all signals comply with the recommended manufacturer's specifications for each item of equipment.
 - b. Set signal levels to NTSC RS-170A specifications for luminance level and chroma level, gain and phase.
 - c. Test signals for differential phase, differential gain, chrominance to luminance delay, multi burst frequency response and signal to noise ratio.
 - d. After equipment alignment, check all signal paths from the most up-stream point in the system to verify unity gain at the final destination. Set all equalizing video distribution amplifiers to achieve correct luminance and chrominance gain at each signal destination.
 - e. Measure and record initial conditions for black level, gain level, color level values, tint and gray scale values prior to making any adjustments.
 - f. Measure and record final conditions for black level, gain level, color level values, tint and gray scale values after making any adjustments.
 - g. Observe each signal for AC hum or noise. Correct as required so that no hum or noise is either visible in the displayed pictures or detectable on a scope.
2. Audio:
 - a. Measure and record impedance of each speaker load at the main junction box or rack cabinet and total load on each amplifier. At a minimum, make measurements at 100, 1000, and 10,000 Hertz.
 - b. Make corrections as required so that the load impedance of each amp is equal to or greater than rated load impedance.
 - c. Slowly sweep all low frequency and full range speaker systems with sine waves at 25% of rated maximum amplifier power output, or at 50% of rated continuous power capacity of loudspeakers, whichever is less, from 20 to 2000 Hertz. Observe for audible or perceptible vibration or rattling of speaker components, mounting apparatus, or building elements. Under this Section, correct vibration or rattling of speakers or mounting apparatus to the satisfaction of the Engineer. Report vibration or rattling of other building elements to the Engineer; include frequency, characterization of observed rattling or vibration, and recommendations for correcting the rattling or vibration in the report.
 - d. For each system, measure and record the following:
 - 1) Acoustic frequency response at three locations in each listening area.
 - 2) Acoustic noise floor with all microphone inputs at full gain, or at gain settings which correspond to the onset of ringing for a single microphone, whichever is lower gain, and other controls at normal settings. During test, terminate microphone receptacles with 200 ohm resistors.
 - 3) Maximum sound pressure level of pink noise at onset of amplifier clipping. Make measurement using both A-weighted and unweighted (flat) settings of the Sound Level Meter (SLM).
 - 4) Perform tests with the measuring microphone at the seated ear height of the audience, within designated seating areas. All interior finishes and furnishings shall be in place during measurements.
 - e. Make the above measurements for all loudspeaker systems.
3. CATV/RF:
 - a. Terminate all unused ports on splitters, taps, combiners, and amplifiers into 75 ohms with an approved terminator.

- b. Sweep test the overall system with a spectrum analyzer from the head-end location to the last outlet in each distribution leg of the system.
- c. Use a return loss bridge to verify that the return loss of the system is a minimum of 26dB below signal levels at the room taps. VSWR will not exceed 1.4:1.
- d. Certify that no frequency dropouts are present in the system which would affect any of the VHF channels. Using a properly calibrated field strength meter, measure and record at 55.25MHz and 319.25MHz, the output levels at each TV tap in the system. Certify that the system shall deliver a minimum signal level of +3dBmV, + 4dB at each TV tap.
- e. Submit copies of the test results as described above prior to final acceptance and training. Include copies of the test results in the O&M manuals. Include the names of the individuals performing and witnessing the tests, and the manufacturer's name and model number of the test equipment used. Include a block diagram of the test setup for each test.

E. Adjustments

1. Video Signals:

- a. Verify that all signals comply with the recommended manufacturer's specifications for each item of equipment.
- b. Set signal levels to NTSC RS-170A specifications for luminance level and chroma level, gain and phase.
- c. Test signals for differential phase, differential gain, chrominance to luminance delay, multi burst frequency response and signal to noise ratio.
- d. After equipment alignment, check all signal paths from the most up-stream point in the system to verify unity gain at the final destination. Set all equalizing video distribution amplifiers to achieve correct luminance and chrominance gain at each signal destination.

2. Audio signals:

- a. Verify that all microphones have the same polarity of output for positive pressure at diaphragm.
- b. Verify that positive pressure at a microphone produces positive pressure from each loudspeaker. Reverse polarity if required, and record which circuit was reversed.
- c. Verify that signal polarity is correct for each circuit and path, and consistent for all circuits and paths. Reverse polarity if required, and record which circuit was reversed.
- d. Adjust gain controls so all components except power amplifiers reach rated nominal output simultaneously. For components which have rated maximum outputs between 18 and 25dBm and line level inputs, adjust each component for unity gain (i.e., assume all such components have rated outputs equal to 20dBm, and nominal outputs of 0dBm).
- e. Set audio distribution amplifiers for unity gain unless otherwise specified by the Engineer.
- f. Adjust power amplifier gains so power amplifiers reach clipping at 10 decibels above 0 volume units on the control console output meter.
- g. Re-adjust gains if required for proper operation of each system and component. Measure and record any such re-adjustments; also record the reason adjustment was deemed necessary.
- h. Adjust equalizers to optimize the specified frequency responses.
- i. Perform final equalization in the presence of the Engineer.

- j. Adjust automatic mixers, automatic level controllers, and other signal processors to optimize use of microphones for teleconferencing with speech using the expected (normal) microphone positions.
 - k. Measure and record the overall frequency response and signal to noise of each complete signal path.
 - l. Verify that the system is completely free from hum, noise, parasitic oscillation, and RFI.
3. RF Signals:
- a. Verify that all signals comply with the recommended manufacturer's specifications for each item of equipment.
 - b. Adjust amplifier outputs and tilt compensation as required to meet system performance specifications.
 - c. Measure and record the overall frequency response and signal to noise of each complete signal path.
 - d. Insert pads or equalizers in signal chain as required to meet the system performance specifications.

3.15 SYSTEM ACCEPTANCE TESTS

- A. System Acceptance Tests will not be performed until the Contractor's System Checkout has been completed and the test results have been reviewed. The System Acceptance Tests will be supervised by the Consultant and will consist of the following:
- B. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents.
- C. The operation of all system equipment shall be demonstrated by the Contractor.
- D. The operation of the control systems / touch panels will be reviewed for acceptance by the Owner.
- E. Both subjective and objective tests will be required by the Consultant to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.
- F. All final, "as-built" drawings, run sheets, manuals, and other required documents, as detailed in Section 111-D-3, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to the Consultant prior to the scheduling of Acceptance Tests).
- G. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Consultant.
- H. Any charge for additional time incurred by the Consultant required to oversee the system tests, due to improper system installation or previous failed systems, shall be the responsibility of and charged directly to the Contractor.

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AUDIO-VIDEO EQUIPMENT LIST

AQUA ROOM - COUNCIL CHAMBERS			
MFG	PART#	DESCRIPTION	QUANTITY
LG	49VL5GMW-9P 49" 1920 x 1080 3x3 49VL5G-M	3X3 VIDEO WALL W/ PEERLESS VIDEO WALL MOUNT	2
PTZOptics	PT12X-USB-WH-G2	PTZ CAMERA	2
PTZOptics	HCM-1-WH	CAMERA WALL MOUNT	2
Salt	Crossbow 4x1 Quadview	HDMI SWITCHER	1
Magwell	USB CAPTURE	HDMI TO USB CONVERTOR	1
Crestron	HD-TX-101-C-1G-E-W-T	HDMI DM TRANSMITTER - WALL PLATE	2
Crestron	HD-RX-101-C-E	HDMI DM RECEIVER	2
QSC	AD-P6T	PENDENT SPEAKER	9
QSC	AD-C6T-WH	RECESSED CEILING SPEAKER	6
QSC	MP-A40V	4 CH. AUDIO AMPLIFIER	1
QSC	Core 110F	AUDIO DSP	1
Shure	MX418D/C	WIRED GOOSENECK MIC W/ PROGRAMABLE BASE	7
Shure	CVO	CEILING MOUNTED MICROPHONE - WHITE	2
Sennheiser	EW-D ME2/835-S SET	WIRELESS HH MIC & BELTPACK LAV COMBO	1
Sennheiser	EW-D 835-S SET	WIRELESS HH MIC	1
Crestron	CP4	CONTROL SYSTEM PROCESSOR	1
Crestron	UC-CX100-Z	CRESTRON FLEX ADVANCED INTERGATOR KIT FOR ZOOM	1
Crestron	UC-FLEXCARE-C	CRESTRON FLEX SUPPORT AGREEMENT (1-YEAR)	1
Crestron	HD-TX-101-C-1G-E-W-T	DM LITE TRANSMITTER FOR HDMI	3
Crestron	HD-RX-101-C-E	DM LITE RECEIVER FOR HDMI	1
Crestron	HD-RXC-101-C-E	DM LITE RECEIVER FOR HDMI W/ CONTROL	2
Crestron	HD-PS622	8x2 4K60 4:4:4 HDR PRESENTATION SYSTEM	1
Crestron	TSW-1070	10" TOUCHPANEL	1
Cisco	350-10P	ENET SWITCH	1
IOGear	IOGEAR GUS432CA1KIT 2x4 USB 3.0	USB SWITCH	1
Barco	ClickShare C-5	WIRELESS AV COLLABORATION SYSTEM	1
Williams Sound	FM 558 PRO	ASSISTED LISTENING SYSTEM	1
Williams Sound	C5-2N Loop System	ASSISTED LISTENING INDUCTIVE LOOP SYSTEM	1
Lowell	LER-3522	35 SPACE EQUIPMENT RACK	1
Lowell	LFD-35	EQUIPMENT RACK DOOR	1
Lowell	UDEL-314	3 RU EQUIPMENT RACK DRAWER	1

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Furman	PL-8C	POWER CONDITIONER	1
Lowell	ACS-1524	VERTICAL POWER STRIP	1
OWNER FURNISHED		RACK MOUNT COMPUTER	1

LITTLEFIELD ROOM - MEDIUM CONFERENCE ROOM			
MFG	PART#	DESCRIPTION	QUANTITY
Samsung	75UR340C9UD	75" DISPLAY	1
Peerless	SA771PU	DISPLAY WALL MOUNT	1
Crestron	RMC4	CONTROL SYSTEM	1
Crestron	UC-CX100-Z	CRESTRON FLEX ADVANCED INTERGATOR KIT FOR ZOOM	1
Crestron	UC-FLEXCARE-C	CRESTRON FLEX SUPPORT AGREEMENT (1-YEAR)	1
Crestron	HD-RX-101-C-E	DM LITE RECEIVER FOR HDMI	1
Crestron	HD-TX-101-C-1G-E-W-T	DM LITE TRANSMITTER FOR HDMI	1
Barco	ClickShare C-5	WIRELESS AV COLLABORATION SYSTEM	1
Cisco	CBS350-10P	ETHERNET SWITCH	1
Strong	SM-VP-10X12-BLK	DISPLAY EQUIPMENT MOUNTING PLATE	1
Huddly	L1 - 7090043790672	WEBCAM FOR LARGE AND MEDIUM ROOMS	1
TOA	LeNubio AM-CF1W	COLLABORATION SYSTEM SOUNDBAR & MIC ARRAY	1

KINGS ROOM - LARGE CONFERENCE ROOM			
MFG	PART#	DESCRIPTION	QUANTITY
Samsung	86UR340C9UD	86" DISPLAY	1
Peerless	SA771PU	DISPLAY WALL MOUNT	1
Crestron	RMC4	CONTROL SYSTEM	1
Crestron	UC-CX100-Z	CRESTRON FLEX ADVANCED INTERGATOR KIT FOR ZOOM	1
Crestron	UC-FLEXCARE-C	CRESTRON FLEX SUPPORT AGREEMENT (1-YEAR)	1
Crestron	HD-RX-101-C-E	DM LITE RECEIVER FOR HDMI	1
Crestron	HD-TX-101-C-1G-E-W-T	DM LITE TRANSMITTER FOR HDMI	1
Barco	ClickShare C-5	WIRELESS AV COLLABORATION SYSTEM	1
Cisco	CBS350-10P	ETHERNET SWITCH	1

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Strong	SM-VP-10X12-BLK	DISPLAY EQUIPMENT MOUNTING PLATE	1
Huddly	L1 - 7090043790672	WEBCAM FOR LARGE AND MEDIUM ROOMS	1
TOA	LeNubio AM-CF1W	COLLABORATION SYSTEM SOUNDBAR & MIC ARRAY	1

SOCKEYE ROOM - MEDIUM CONFERENCE ROOM			
MFG	PART#	DESCRIPTION	QUANTITY
Samsung	75UR340C9UD	75" DISPLAY	1
Peerless	SA771PU	DISPLAY WALL MOUNT	1
Crestron	RMC4	CONTROL SYSTEM	1
Crestron	UC-CX100-Z	CRESTRON FLEX ADVANCED INTERGATOR KIT FOR ZOOM	1
Crestron	UC-FLEXCARE-C	CRESTRON FLEX SUPPORT AGREEMENT (1-YEAR)	1
Crestron	HD-RX-101-C-E	DM LITE RECEIVER FOR HDMI	1
Crestron	HD-TX-101-C-1G-E-W-T	DM LITE TRANSMITTER FOR HDMI	1
Barco	ClickShare C-5	WIRELESS AV COLLABORATION SYSTEM	1
Cisco	CBS350-10P	ETHERNET SWITCH	1
Strong	SM-VP-10X12-BLK	DISPLAY EQUIPMENT MOUNTING PLATE	1
Huddly	L1 - 7090043790672	WEBCAM FOR LARGE AND MEDIUM ROOMS	1
TOA	LeNubio AM-CF1W	COLLABORATION SYSTEM SOUNDBAR & MIC ARRAY	1

COHO ROOM - SMALL CONFERENCE ROOM			
MFG	PART#	DESCRIPTION	QUANTITY
Samsung	55UR340C9UDRBX	55" DISPLAY	1
Peerless	SA761PU	DISPLAY WALL MOUNT	1
Crestron	RMC4	CONTROL SYSTEM	1
Crestron	UC-BX30-Z	CRESTRON FLEX ADVANCED INTERGATOR KIT FOR ZOOM	1
Crestron	UC-FLEXCARE-C	CRESTRON FLEX SUPPORT AGREEMENT (1-YEAR)	1
Crestron	HD-RX-101-C-E	DM LITE RECEIVER FOR HDMI	1
Crestron	HD-TX-101-C-1G-E-W-T	DM LITE TRANSMITTER FOR HDMI	1
Barco	ClickShare C-5	WIRELESS AV COLLABORATION SYSTEM	1
Cisco	CBS350-10P	ETHERNET SWITCH	1
Strong	SM-VP-10X12-BLK	DISPLAY EQUIPMENT MOUNTING PLATE	1

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GEORGE'S ROOM - PRIVATE OFFICE			
MFG	PART#	DESCRIPTION	QUANTITY
Samsung	55UR340C9UDRBX	55" DISPLAY	1
Peerless	SA761PU	DISPLAY WALL MOUNT	1
Crestron	RMC4	CONTROL SYSTEM	1
Crestron	UC-BX30-Z	CRESTRON FLEX ADVANCED INTERGATOR KIT FOR ZOOM	1
Crestron	UC-FLEXCARE-C	CRESTRON FLEX SUPPORT AGREEMENT (1-YEAR)	1
Crestron	HD-RX-101-C-E	DM LITE RECEIVER FOR HDMI	1
Crestron	HD-TX-101-C-1G-E-W-T	DM LITE TRANSMITTER FOR HDMI	1
Barco	ClickShare C-5	WIRELESS AV COLLABORATION SYSTEM	1
Cisco	CBS350-10P	ETHERNET SWITCH	1
Strong	SM-VP-10X12-BLK	DISPLAY EQUIPMENT MOUNTING PLATE	1

**SECTION 284600
FIRE DETECTION AND ALARM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

- A. Section 212200 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.
- B. Section 260548 - Vibration and Seismic Controls for Electrical Systems: Requirements for the seismic qualification of equipment specified in this section.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3300 Submittal Proceduresv , for submittal procedures.
- B. Proposal Documents: Submit the following with cost/time proposal:
 - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
 - 3. Certification by Contractor that the system design will comply with Contract Documents.
 - 4. Proposed maintenance contract.
- C. Evidence of designer qualifications.
- D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.

7. List of all devices on each signaling line circuit, with spare capacity indicated.
 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 12. Certification by Contractor that the system design complies with Contract Documents.
- E. Manufacturer's equipment seismic qualification certification.
- F. Evidence of installer qualifications.
- G. Evidence of instructor qualifications; training lesson plan outline.
- H. Evidence of maintenance contractor qualifications, if different from installer.
- I. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
 2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- J. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- K. Project Record Documents: Have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- L. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
 3. Certificate of Occupancy.
 4. Maintenance contract.

1.05 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

- B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 - 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 - 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 WARRANTY

- A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units and Accessories:
 - 1. Honeywell Security & Fire Solutions/Silent Knight; _____: www.silentknight.com/#sle.
 - 2. Potter Electric Signal Company; _____: www.pottersignal.com/#sle.
 - 3. Siemens Building Technologies, Inc; _____: www.usa.siemens.com/#sle.
 - 4. Simplex, a brand of Johnson Controls; _____: www.simplex-fire.com/#sle.
 - 5. Provide control units made by the same manufacturer.
- B. Initiating Devices and Notification Appliances:
 - 1. Honeywell Security & Fire Solutions/Notifier; _____: www.notifier.com/#sle.
 - 2. Honeywell Security & Fire Solutions/Silent Knight; _____: www.silentknight.com/#sle.
 - 3. Siemens Building Technologies, Inc; _____: www.sbt.siemens.com/#sle.
 - 4. Simplex, a brand of Johnson Controls; _____: www.simplex-fire.com/#sle.
 - 5. Same manufacturer as control units.
 - 6. Provide initiating devices and notification appliances made by the same manufacturer, where possible.
- C. Substitutions:
 - 1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
 - 2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 - 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.

2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction .
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 101.
 - g. NFPA 72; where the word "should" or "shall is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
6. Fire Alarm Control Unit: New, located at the location shown on plans..
- B. Supervising Stations and Fire Department Connections:
 1. Public Fire Department Notification: By remote supervising station.
 2. Remote Supervising Station: UL-listed central station under contract to facility.
 3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
 4. Auxiliary Connection Type: Parallel telephone.
- C. Circuits:
 1. Initiating Device Circuits (IDC): Class A.
 2. Signaling Line Circuits (SLC) Within Single Building: Class A.
 3. Notification Appliance Circuits (NAC): Class A.
- D. Spare Capacity:
 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
 1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 4. Each Computer System: Provide uninterruptible power supply (UPS).
- F. Seismic Qualification: Provide fire alarm system and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following, when present:
 1. Sprinkler water control valves.
 2. Dry-pipe sprinkler system pressure.
 3. Dry-pipe sprinkler valve room low temperature.
 4. Sprinkler water storage tank low level.
 5. Sprinkler water storage tank low temperature.
 6. Fire pump(s).
 7. Elevator shut-down control circuits.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 1. Sprinkler water flow.

2. Total flooding suppression system activation.
 3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
 4. Duct smoke detectors.
- C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
 3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.04 COMPONENTS

- A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: _____.
- D. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
 2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
 3. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
 4. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.
- E. Initiating Devices:
1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
 2. Manual Pull Stations: _____.
 3. Smoke Detectors: _____.
 4. Duct Smoke Detectors: _____.
 5. Heat Detectors: _____.
- F. Notification Appliances:
1. Speakers: _____.
 2. Strobes: _____.
- G. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.
- H. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- I. Locks and Keys: Deliver keys to Owner.

1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
- J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 2. Provide one for each control unit where operations are to be performed.
 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 4. Provide extra copy with operation and maintenance data submittal.
- K. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
 1. Padlock eye and hasp for lock furnished by Owner.
 2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 1. Record all system operations and malfunctions.
 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 1. Hands-On Instruction: On-site, using operational system.
 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 1. Initial Training: 1 session pre-closeout.

- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.
- B. Occupancy of the project will not occur prior to Substantial Completion.
- C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 - 1. Specified diagnostic period without malfunction has been completed.
 - 2. Approved operating and maintenance data has been delivered.
 - 3. All aspects of operation have been demonstrated to Owner.
 - 4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
 - 5. Occupancy permit has been granted.
 - 6. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

- A. Provide to Owner, at no extra cost, a written maintenance contract for 2 years, to include the work described below.
- B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- C. Provide trouble call-back service upon notification by Owner:
 - 1. Provide on-site response within 2 hours of notification.
 - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- F. Comply with Owner's requirements for access to facility and security.

END OF SECTION 284600

SECTION 31 10 00 - SITE CLEARING

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. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Stripping and stockpiling rock.
 - 6. Removing above- and below-grade site improvements.
 - 7. Temporary erosion and sedimentation control.

1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally 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 larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

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

1.5 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or video recordings.
- B. Topsoil stripping and stockpiling program.
- C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
- D. Burning: Burning is not permitted.

1.6 FIELD 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 trafficways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify 811 for area where Project is located before site clearing. Private locator serve companies may be required for private utility improvements. Engage such a service if private buried utilities are indicated as present on the plans.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and any plant protection measures are in place.
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- 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 erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. Interrupting 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 seven days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Clearing work shall be performed within the confines of the area indicated on the Drawings, or in the Specifications.
- B. Remove obstructions, trees, shrubs, 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. Do not remove trees, shrubs, and other vegetation outside of the confines of the property line as shown on the Plans.
 - 3. Grind down stumps and remove roots larger than 2 inches (50 mm) in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods or air spade for grubbing within protection zones.
 - 5. Chip removed tree branches and dispose of off-site.
- C. 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 (200 mm), and compact each layer to a density equal to adjacent original ground.
- D. No logs, stumps, rocks, etc., shall be left lying in the right-of-way or on adjacent property without specified written approval by the Owner.
- E. All trees shall be felled within the area to be cleared except those marked to be left standing, or required by easement stipulations or by contract to be left standing. Trees shall be close cut parallel to the ground, removed and disposed of at the expense of the Contractor.
- F. No trees or shrubbery in public right-of-way shall be cut except by approval of the Engineer.
- G. All trees or stumps within five (5) feet of a pipeline shall be removed.
- H. Grubbing will be performed where designated on the drawings or as specified herein and shall include removal from the ground of all stumps, roots, buried logs and other vegetation not otherwise provided for and the removal and disposal of the refuse.
- I. In areas to be filled to a depth of three (3) feet or more above the natural ground all tree stumps and brush shall be cut off not more than three (3) inches from the ground and removed.
- J. Where unsuitable surface material is to be removed, complete grubbing will be required.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.

- B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within protection zones.
 - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and 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 along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. 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.
- B. Burning of other waste and debris is prohibited.
- C. 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. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

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. Excavating and filling for rough grading the Site.
2. Preparing subgrades.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

1.3 GENERAL REQUIREMENTS

- A. The Contractor shall make his own estimate of the kind and extent of materials which will be encountered in the excavation.
- B. The Contractor shall provide, complete, all excavation, removal, stockpiling, disposal and backfilling of whatsoever nature necessary for construction of all structures.
- C. The Contractor shall provide all construction, and subsequent removal of all shoring, cribs and cofferdams that may be necessary for protection of existing structures; excavation; removal or construction of structures; and placement and compaction of backfill.
- D. Excavation for catch basins, valve vaults and other similar utility structures specified herein.

1.4 DEFINITIONS

- A. All excavation is unclassified unless separate bid item is included in bid form.
- B. The terms earthwork or excavation include all materials excavated or removed regardless of material characteristics.

- C. 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.
- D. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- E. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- F. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- G. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- H. 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 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.
- I. Fill: Soil materials used to raise existing grades.
- J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
- K. 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.
- L. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- M. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- N. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Geofoam.
 - 4. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches (300 by 300 mm).
 - 2. Warning Tape: 12 inches (300 mm) long; of each color.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 1557.
- C. 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 earth-moving operations. Submit before earth moving begins.
- D. Density test results in approved format.

1.7 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Moisture Density Standard ASTM D1557 or AASHTO T-180 unless otherwise approved.
 - 1. Density determination in field: Sandcone method ASTM D1556 or Nuclear method ASTM D6938 unless otherwise approved.
- C. Classification of Soils: ASTM D2487.
- D. Quality control monitoring of subgrade backfill and embankment materials and construction by certified independent laboratory approved by Engineer and secured and paid for by the Contractor.

1.8 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving 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 Owner or authorities having jurisdiction.
- B. Retain "Utility Locator Service" Paragraph below if required and not specified in Section 311000 "Site Clearing"; revise to suit Project. First option is a generic term that is known in various states by different names listed in the other options. See Evaluations.
- C. Utility Locator Service: Notify 811 for area where Project is located before beginning earth-moving operations. If private utilities are noted on the Plans, also engage a private utility locator service to locate utilities that cannot be located through 811.
- D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015723 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.

1.9 DEWATERING QUALITY CONTROL

- A. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.
- B. The Contractor shall employ an independent qualified Professional Engineer with experience in similar dewatering problems to review and approve the Contractor's proposed method of dewatering and to at least weekly, inspect the Contractor's operations and provide a report to the Engineer.
- C. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.
- D. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points should be established and observed at frequent intervals to detect any settlement which may develop. Should significant settlement be observed, recharge wells could be placed between the structure and the trench and water pumped under pressure back into the soil.
- E. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Materials contained with WSDOT Division 9 Standards are acceptable unless otherwise specified herein.

- B. Satisfactory Soils: Soils meeting the requirements of the Project's Geotechnical Report; free of rock or gravel larger than 6 inches (150 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Subbase Material/ Crushed Surfacing Top Course: Material conforming to WSDOT Standard 9-03.9(3).
- D. Base Course/Crushed Surfacing Base Course: Material conforming to WSDOT Standard 9-03.10.
- E. Engineered Fill/Gravel Borrow: Material conforming to WSDOT Standard 9-03.14(1).
 - 1. Structural backfill shall conform to WSDOT Standard 9-03-12(1) or 9-03-12(2) as appropriate to Foundations and Walls respectively.
 - 2. Structural backfill for structural earth walls shall conform to WSDOT Standard 9-03-14(4).
- F. Bedding Course: Material conforming to WSDOT Standard 9-03.12(3).
- G. Drainage Course: Material conforming to WSDOT Standard 9-03.12(4).
- H. 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 zero to 5 percent passing a No. 4 (4.75-mm) sieve.
- I. Sand: ASTM C 33/C 33M; fine aggregate conforming to WSDOT Standard 9-03.13.
- J. Bank Run Gravel: Material conforming to WSDOT Standard 9-03.19.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- L. Foundation Material: Material conforming to WSDOT Standard 9-03.18.

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. Survivability: As follows:
 - a. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
 - b. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
 - c. Tear Strength: 56 lbf (250 N); ASTM D 4533.
 - d. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
 - 3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - 4. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - 5. 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: As follows:
 - a. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
 - b. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
 - c. Tear Strength: 90 lbf (400 N); ASTM D 4533.
 - d. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
 - 2. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - 3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting flowable concrete material produced from the following:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I
 - 2. Fly Ash: ASTM C 618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM C 33/C 33M, 3/8-inch (10-mm) nominal maximum aggregate size.
 - 4. Water: ASTM C 94/C 94M.
 - 5. Air-Entraining Admixture: ASTM C 260/C 260M.
- B. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495/C 495M.

2.4 EQUIPMENT

- A. Before operations begin, the Contractor shall have available on the site of work sufficient pumping equipment and/or other machinery to assure that the operation of the dewatering system can be maintained.

PART 3 - EXECUTION

3.1 EXCAVATION PREPARATION

- A. The Contractor shall exercise care and caution in performing the work so as not to cause any slide or slip beyond the limits of the excavation. The Contractor shall be responsible for damages to abutting improvements and properties resulting from any slide or slip, whatever the cause. The Contractor shall also at their own expense, remove the loose material and backfill or repair the slide or slip area with granular material, lean concrete, or by other method or means with the approval of the Owner.
- B. The excavation shall be dewatered as described in herein during excavation, construction of facilities and placement and compaction of backfill.

- C. Excavation, sloped back sufficiently to prevent sliding or shoring, shall be provided. Design of shoring is responsibility of the Contractor.
- D. All excavated material unsuitable or surplus for backfill and embankment shall be removed from the project site to a dump site by the Contractor.
- E. Excavated material suitable for Backfill and Embankment shall be stockpiled.
- F. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- G. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- H. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Dewatering shall be done by such method as the Contractor may elect.
- B. Dewatering, sufficient to maintain the groundwater level at or below the surface of trench bottom or base of the foundation gravel shall be accomplished prior to excavation and placing of pipeline or concrete. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavation.
- C. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sand packed and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.
- D. Contractor to provide equipment and labor required to prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area such that a reasonably dry excavated area is maintained.
 - 1. Surface water includes but is not limited to: Flows within streams and natural water courses, natural or artificial ponds, sheet flows from storms water, and existing storm drainage within pipes, catch basins, and infiltration areas.
 - 2. Groundwater levels are typically maintained below foundation subgrade elevations to permit allowable load bearing capacities to be achieved. Dewatering within foundation excavations shall not be permitted.
 - 3. Control methods include items such as perimeter or curtain drains and pumps.
 - 4. Water within trench excavations shall not enter the pipe at any time or cause flotation of the pipe.
- E. 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.

- F. Dewatering shall be continuously utilized on the site to meet the above objectives during the construction including weekends, holidays, and work stoppages.
- G. Disposal of Dewatering water shall meet WSDOT Standard 8-01.3(1)C1.
- H. The normal water table shall be restored to its natural level in such a manner as to not disturb the pipe, its foundation and structures.
- I. Permanent piping systems shall not be incorporated in the dewatering system.

3.3 EXPLOSIVES

- A. Explosives: Explosives are not permitted for use.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR GRADING

- A. Remove all materials required regardless of type or character.
- B. Excavate to lines and grades shown on the drawing.
- C. Transport all materials to embankment areas or to waste as required.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). 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. Ground shall not be dug by machinery nearer than 3 inches from any finished subgrade. The last 3 inches shall be removed without disturbing the subgrade
 - 2. 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 (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.
- C. Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require over-excavation and backfill, the Contractor shall refill such excavated space to the proper elevation with foundation gravel.
- D. Foundation shall be dug to final grade so that subgrade is not disturbed.
- E. The foundation and slab subgrade bearing areas shall be protected from disturbance with a 12-inch minimum layer of foundation gravel compacted to a minimum density of 95% modified Proctor.
- F. During the course of excavation, the Engineer may stop the work for additional bearing tests or test borings, and the Contractor shall give any assistance the Engineer may need in making such tests and shall receive no extra compensation for such stoppages. Materials and labor furnished by the Contractor for such tests will be considered as incidental to the work.
- G. When the foundation excavation is completed, the Contractor shall notify the Engineer who will inspect and approve the work before any additional work or structure is placed thereon.
- H. Contractor shall additionally notify the Engineer on completion of placement of foundation gravel. The Engineer will then inspect and review the compaction test reports and approve the work before any additional work or structure is placed thereon.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of pipe as shown on the Typical Trench Restoration Detail WT1-1 on the plans.
- 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 6 inches (150 mm) higher than top of pipe or conduit unless otherwise indicated.
- C. Trenching for Sewers and Drains
 - 1. Trenches must be of sufficient width to permit proper jointing of the pipe and back-filling of material along the sides of the pipe.
 - 2. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner.
 - 3. Trenches wider than the maximum specified may result in a greater load of overburden than the pipe is designed for, and consequently, if the maximum trench width is exceeded by the Contractor, the Contractor shall at his own expense, provide pipe of higher strength classification, or provide a higher class of bedding where necessary to assure that the pipe will not be overloaded.
 - 4. The normal maximum permissible trench width, at the bottom of the trench and up to a point at the crown of the pipe, shall be 1.5 times the inside diameter plus 18 inches, or a total of 40 inches, whichever is greater.
 - 5. Excavation for manholes and other structures shall be sufficient to provide a minimum of 12 inches between their outside surfaces and the sides of the excavation.
 - 6. The length of trench excavated in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed 150 feet unless specifically authorized by the Engineer.
 - 7. Trenches shall be excavated below the barrel of the pipe a sufficient distance to provide for gravel bedding specified. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
- E. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 1. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions as shown on the Plans.
 - 2. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - 3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

- F. Trench Bottoms: Excavate trenches 6 inches (150 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - 1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- G. Material shall be excavated from trenches and piled adjacent to the trench and maintained so that the toe of the slope of the spoil material is at least 2 feet from the edge of the trench or hauled from the trench to an approved disposal or storage site.
- H. Material shall be piled in such a manner that will cause a minimum of inconvenience to public travel.
- I. Free access shall be provided to all fire hydrants, water valves and meters, and clearance shall be left to enable the free flow of storm water in all gutters, conduits, and natural watercourses.
- J. Ledge rock, boulders, or stones shall be removed to provide a minimum clearance of 6 inches under and around the pipe to be installed.
- K. Contractor shall keep excavations free of water in accordance with this Section.
- L. Contractor is responsible for shoring in accordance with Section 31 50 00.

3.9 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 a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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 repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, 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 changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 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 (17.2 MPa), may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.11 PIPE FOUNDATIONS

- A. Where the trench bottom is in a material which is unsuitable for foundation or which will make it difficult to obtain uniform bearing for the pipe, such material shall be removed and a stable foundation provided.
- B. Proper preparation of foundation and placement of foundation material, where required, shall precede the installation of all pipe.
- C. Proper preparation includes bringing the native trench bottom and/or the top of the foundation material to a uniform grade so that the entire length of pipe rests firmly on suitable, properly compacted material.
- D. Gravel to be used for foundation purposes shall be of a type and gradation to provide solid compact bedding in the trench. Because trench conditions vary, foundation gravel requirements will change.
- E. Neither approval nor disapproval of the foundation material proposed by the Contractor shall relieve him of his responsibility to provide adequate pipe foundation and to guarantee his work as elsewhere required by the Contract.
- F. Unsuitable material for foundation purposes below the depth required for the specified bedding shall be removed and replaced with suitable foundation gravel.
- G. Excavated materials shall be disposed of at an approved waste site and all costs involved in the excavating and wasting of this material shall be considered as incidental to the installation.

3.12 PIPE BEDDING

- A. Placement of gravel bedding in the pipe zone shall be as specified in the section regarding pipeline construction.

3.13 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 and excessive moisture from precipitation.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
 2. Material that becomes too wet or contaminated in the stockpile shall be hauled to a disposal site and replaced with suitable imported material at the Contractor's expense.

3.14 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, 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.
- C. Structure backfill shall not be placed until the subgrade portions of the structure have been inspected by the Engineer.
- D. No backfill material shall be deposited against concrete structures until the concrete has developed a strength of not less than 3000 pounds per square inch in compression, or until the concrete has been in place for 28 days, whichever occurs first.

3.15 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Temporary shoring shall be removed unless specifically authorized in writing.
- C. Dewatering shall be continued until the trench is completely backfilled.
- D. 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.
- E. Gravel bedding to 6 inches over the top of the pipe shall be completed before backfilling operations are started.
- F. The Contractor shall take all necessary precautions to protect the pipe from any damage, movement or shifting. In general, backfilling shall be performed by pushing the material from the end of the trench into, along and directly over the pipe so that the material will be applied in the form of a rolling slope rather than by side filling which may damage the pipe. Backfilling from the sides of the trench will be permitted after sufficient material has first been carefully placed over the pipe to such a depth as to protect the pipe.
- G. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete."
- H. Backfill voids with satisfactory native soil or gravel borrow while removing shoring and bracing.

- I. Initial Backfill:
 - 1. Soil Backfill: Place and compact initial bedding to a height of 6 inches (150 mm) over the pipe or conduit. Utilize materials as specified on Plans.
 - a. Carefully compact bedding under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- J. Final Backfill:
 - 1. Soil Backfill: Place and compact gravel borrow or suitable on-site material to final subgrade elevation.
- K. Identification:
 - 1. Materials and their installation are specified in Section 33 05 26 "Utility Identification".

3.16 SOIL FILL

- A. Notify Engineer of any discrepancies between contractual requirements and site conditions prior to start of work.
- B. All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsuitable materials within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started.
- C. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed, shall be plowed, stepped (benched), or broken up in such manner that the fill material will bond with the existing surface.
- D. The original ground surface shall be plowed or scarified to a depth of at least six (6) inches and compacted as specified herein.
- E. Soft, wet soils shall be excavated and replaced or allowed to dry before placing fill.
- F. Maintain backfill embankment and subgrade zones or lifts open until approval of testing is secured from the Engineer. Any work covered up prior to approval shall be excavated and reconstructed at Contractor's expense.
- G. Prior to pipe installation construct embankments a minimum of 12 inches above pipe crowns and trench for all pipelines. Mounding over pipelines will not be permitted.
- H. 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 engineered fill.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.

- I. Contours illustrated are intended as a general guide to achieve proper aesthetics and drainage control.
- J. Control grid and spot elevations to be established by Contractor.
- K. Vary control grid spacing to accurately define slope, rounding of mounds and depressions.
- L. Field staking of certain intermediate grid points at locations where slopes are uniform may, at Engineer's discretion, be eliminated.
- M. Finished surface shall be smooth, compacted and free from irregular surface change so as to drain readily.
- N. The degree of finish shall be that ordinarily obtainable from blade grader operations, except as otherwise specified. The finished surfaces not to be paved shall be not more than 0.15 feet above or below the established grade or approved cross section. All areas to be paved shall be finished as required for pavement subgrade.
- O. Place soil fill on subgrades free of mud, frost, snow, or ice.
- P. Work in inclement wet weather at Contractor's risk.
- Q. Any materials which become unstable as the result of improper selection of techniques, equipment, or operations during inclement wet weather shall be replaced at Contractor's expense with imported material for embankment.
- R. Excavations and embankment shall be accomplished in such a manner that drainage is maintained at all times.
- S. Construct of materials specified, conditioned to proper moisture and texture necessary to assure specified densities.
- T. Loose thickness lifts not to exceed 8 inches.

3.17 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.

3.18 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) unless shown on the plans or authorized by Engineer. Place backfill in loose depth for material compacted by heavy compaction equipment.

1. Place backfill not more than 4 inches (100 mm) 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. Compaction equipment used above the pipe zone shall be of a type that does not injure the pipe.
 - D. Replace the term “unit weight” with “density” if preferred. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.
 - E. Method of compaction shall be at Contractor's option.
 - F. The Contractor shall be responsible to provide the proper size and type of compaction equipment and select the proper method of utilizing said equipment to attain the required compaction density.
- 3.19 CONTROLLED DENSITY FILL (CDF)
- A. Haul excavated material immediately to waste, install and bed pipe per other applicable sections.
 - B. Mix and deliver CDF in commercial concrete ready mix trucks. CDF shall be discharged from the mixer by any reasonable means (which does not segregate the material) into the area to be filled.
 - C. Contain CDF at either end of the excavation by bulkhead or earth fill.
 - D. Place CDF using suitable equipment to avoid injury to or displacement of installed utility lines, manholes, and other structures. CDF shall not be placed on frozen ground.
 - E. Vibrate fill with concrete vibrators during placement for complete consolidation, 95% minimum.
 - F. Provide steel plates to span utility trench and prevent traffic contact with the CDF for at least 12 hours, but not more than 24 hours or until fill has set sufficient to prevent rutting.
 - G. Placement of CDF shall be scheduled during favorable weather conditions. At the time of placement, CDF must have a temperature of at least 40° F. Mixing and placing shall stop when the temperature is 38° F or less and falling. Each filling stage shall be as continuous an operation as practical.

3.20 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 Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm). Grade to elevation to receive topsoil.
 - 2. Walks: Plus or minus 1 inch (25 mm). Grade to elevation to receive base material.
 - 3. Pavements: Plus or minus 1/2 inch (13 mm). Grade to elevation to receive base material.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.21 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.22 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. Install courses in accordance with WSDOT Standard Specification Sections 4-02 and 4-04 and all subsections.

3.23 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.24 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material classification and maximum lift thickness comply with requirements.
 - 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. 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 Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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 one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 300 feet (92 m) or less of trench length but no fewer than two tests.
 4. Structure Backfill: Foundation and backfill zone under/around structures for each one foot of vertical embankment or backfill height; conduct one test for every 300 square feet. Additional tests as required by the Engineer if tests indicate compaction deficiency.
- F. 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 materials to depth required; recompact and retest until specified compaction is obtained.

3.25 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.

3.26 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 3421 - AGGREGATE PIER GROUND IMPROVEMENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Designing, furnishing and installing aggregate pier ground improvement to the lines and grades designated on the project structural foundation plans and civil plans, and as specified herein.
 - 1. Aggregate pier ground improvement as referenced in this specification shall be constructed by a contractor who can demonstrate successful completion of at least five similar projects in Washington State. Air or water jetting is not an approved installation method for this project.
 - 2. The aggregate piers shall be in a columnar-type configuration and shall be used for support of foundation loads and concrete slabs on grade.
 - 3. Footing excavations, and subgrade preparation following aggregate pier installation is not included in this Section.

1.02 RELATED REQUIREMENTS

- A. Division 31 1000 - Site Clearing
- B. Division 31 2000 - Earth Moving
- C. Structural Drawings

1.03 RELATED DOCUMENTS

- A. Geotechnical Report:
 - 1. A geotechnical report has been prepared for this Project and is available for review. The information contained in the report represents the Geotechnical Engineer's interpretation of the subsurface soil and groundwater conditions at the site, the results of laboratory testing, and conclusions and recommendations. Owner will not be responsible for interpretation or conclusions drawn by the Specialty Contractor.
 - 2. The Geotechnical Report was prepared by Associated Earth Sciences Inc. and is titled Skagit Public Utility District (PUD) Mount Vernon, Washington, dated May 27, 2020 revised October 7, 2021.

1.04 REFERENCE STANDARDS

- A. Modulus Testing:
 - 1. ASTM D 1143 - Pile Load Test Procedures
 - 2. ASTM D 1194 - Spread Footing Load Test
 - 3. ASTM D1241- Aggregate Quality
- B. Materials and Inspections:
 - 1. ASTM D 1241 - Aggregate Quality
 - 2. ASTM D 422 - Gradation of Soils

1.05 SUBMITTALS

- A. Design Calculations - The Installer shall submit detailed design calculations and construction drawings prepared by the Aggregate Pier Designer (the Designer) for review by the Owner or Owner's Engineer. All plans shall be sealed by a Professional Engineer, licensed in the State of Washington. Plans and calculations shall be submitted to the Architect and Geotechnical Engineer.
- B. Design Submittal
1. The Installer shall submit detailed, construction drawings, and shop drawings, (the Design Submittal), for approval within two (2) weeks of contract award. A detailed explanation of the design parameters for settlement calculations shall be included in the Design Submittal. Additionally, the quality control test program for Aggregate Pier system, meeting these design requirements, shall be submitted. All computer-generated calculations and drawings shall be prepared and sealed by a Professional Engineer, licensed in the State of Washington. Submittals will be submitted electronically only unless otherwise required by specific submittal instructions.
 2. Permits: The Owner will obtain a grading permit for this project. However, that grading permit will not include the work related to the Aggregate Pier design or installation. The Specialty Contractor shall be responsible for securing all necessary permits from the authorities having jurisdiction over the project for the Aggregate Pier system, including submitting all necessary material for review, paying for, and picking up the permits.
- C. Professional Liability Insurance - The Aggregate Pier Designer shall have Errors and Omissions design insurance for the work. The insurance policy should provide a minimum coverage of \$3 million per occurrence.
- D. Building Code Acceptance - The Aggregate Pier Installer shall demonstrate that the Aggregate Pier system has been evaluated by the International Code Council (formerly ICBO).
- E. Modulus Test Reports - At least one modulus test(s) shall be performed on a production or non-production Aggregate Pier element as required by the Aggregate Pier Designer to verify the design assumptions. The Installer shall furnish the General Contractor a description of the installation equipment, installation records, complete test data, analysis of the test data and verification of the design parameter values based on the modulus test results. The report shall be prepared under direction of a Registered Professional Engineer.
- F. Daily Aggregate Pier Progress Reports - The Installer shall furnish a complete and accurate record of Aggregate Pier installation to the General Contractor. The record shall indicate the pier location, length, volume of aggregate used or number of lifts, densification forces during installation, and final elevations or depths of the base and top of piers. The record shall also indicate the type and size of the installation equipment used, and the type of aggregate used. The Installer shall immediately

report any unusual conditions encountered during installation to the General Contractor, to the Designer and to the Testing Agency.

- G. The Installer shall submit to the General Contractor the following within five working days of the completion of the work:
 - 1. A report documenting the as-built conditions and locations of all Aggregate Piers including perimeter and results of all tests. This report shall certify that the Aggregate Pier system was installed in conformance with these Specifications and the Aggregate Pier Contractor's design, and that Performance Criteria for static and seismic settlement and bearing capacity have been met. The General Contractor shall review the report and coordinate/confirm the locations of foundations and underground work.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Professional Engineer experienced in design of this Work and licensed at the State of Washington.
- B. Demonstrate a minimum of 5 years of experience in the installation of Aggregate Pier Soil Reinforcement and the completion of at least 5 projects in Washington State with construction of a similar size and type. Installer shall be approved by the aggregate pier designer.
- C. Pre-installation conference: Prior to beginning installation of aggregate piers, hold a pre-installation conference to review work to be accomplished.
 - 1. Contractor, Architect, Geotechnical Engineer, Owner's Representative, Owner's Testing Agency, Aggregate Pier Installer, Aggregate Pier Quality Control Technician, and Earthwork Sub-Contractor shall be present.
 - 2. Contractor shall notify Architect at least seven days prior to time for conference.
 - 3. Contractor shall prepare agenda, record minutes of meeting and distribute to attending parties.
 - 4. Agenda: As a minimum discuss:
 - 5. Schedule.
 - 6. Responsibilities.
 - 7. Coordination with other work.
 - 8. Testing and Inspection procedures.
 - 9. Reporting.
 - 10. Protection of installed work.
- D. Independent Engineering Testing Agency (Owner's Quality Assurance).
 - 1. The Owner is responsible for acquiring an Independent Testing Agency (Quality Assurance) as required. Testing Agency roles are as described below. The Aggregate Pier Installer will provide Quality Control services as described in Part 3 of this specification.
 - a. The Aggregate Pier Installer shall provide full-time Quality Control monitoring of Aggregate Pier construction activities.

- E. Responsibilities of Independent Engineering Testing Agency.
1. The Testing Agency shall monitor the modulus test pier installation and testing. The Aggregate Pier Installer shall provide and install all dial indicators and other measuring devices.
 2. The Testing Agency shall monitor the installation of Aggregate Piers to verify that the production installation practices are similar to those used during the installation of the modulus test elements.
 3. The Testing Agency shall report any discrepancies to the Aggregate Pier Installer and General Contractor immediately.
 4. The Testing Agency shall observe the excavation, compaction and placement of the foundations and slabs on grade as described in Part 3.

1.07 AGGREGATE PIER DESIGN

- A. The design of the Aggregate Pier system shall be based on the maximum allowable bearing pressure indicated below under all continuous footings, thickened slabs, slabs on grade, spread footings and grade beams, unless otherwise noted on the plans, and the allowable total and differential settlement criteria of all footings. The Aggregate Pier system shall be designed in accordance with generally-accepted engineering practice and the methods described in Section 1 of these Specifications. The design life of the structure shall be 50 years.
- B. The aggregate pier elements shall be designed for an aggregate pier stiffness modulus of 200 pci. The stiffness modulus value shall be verified by the results of the aggregate pier modulus test, described in this specification.
- C. The aggregate pier system shall be designed to preclude plastic bulging deformations at the top-of-pier and to preclude excessive tip stresses.
- D. The design shall meet the following criteria, along with that noted in the Structural Drawings:
1. Static Ground Improvement Performance requirements:
 - a. Maximum allowable bearing pressure: 5000 PSF
 - b. Estimated total long-term settlement for footings $\leq$ 1-inch
 - c. Differential Settlement: 1/2" between isolated spread footings and along 50 feet of continuous footing
 2. Dynamic Ground Improvement Performance requirements:
 - a. Maximum allowable bearing pressure: 5000 PSF
 - b. Total Post-Seismic Settlement: 1-inch
 - c. Differential Post-Seismic Settlement: 1 inch between isolated spread and footings along 50ft of continuous footing.
- E. Footing as used in this section refer to all continuous footings, thickened slabs, spread footings and grade beams.

PART 2 PRODUCTS

2.01 AGGREGATE

- A. Aggregate used by the Aggregate Pier Installer for pier construction shall be pre-approved by the Designer and shall demonstrate suitable performance during modulus testing. Typical aggregate consists of Type 1 Grade B in accordance with ASTM D-1241-68, No. 57 stone, recycled concrete or other graded aggregate approved by the Designer.
- B. Potable water or other suitable source shall be used to increase aggregate moisture content where required. The General Contractor shall provide such water to the Installer.

PART 3 EXECUTION**3.01 RESPONSIBILITIES OF THE GENERAL CONTRACTOR**

- A. Site Preparation and Protection.
 - 1. The General Contractor shall locate and protect underground and aboveground utilities and other structures from damage during installation of the Aggregate Piers.
 - 2. Site grades for aggregate pier installation shall be within 1 foot of the top of footings or finished grade elevation to minimize aggregate pier installation depths. Ground elevations and bottom of footing elevations shall be provided to the Aggregate Pier Installer in sufficient detail to estimate installation depth elevations to within 3 inches.
 - 3. The General Contractor will provide site access to the Installer, after earthwork in the area has been completed. A working surface shall be established and maintained by the General Contractor to provide wet weather protection of the subgrade and to provide access for efficient operation of the Aggregate Pier installation.
 - 4. Prior to, during and following Aggregate Pier installation, the General Contractor shall provide positive drainage to protect the site from wet weather and surface ponding of water.
- B. Aggregate Pier Layout.
 - 1. The location of aggregate pier-supported foundations and slabs on grade for this project, including layout of individual aggregate pier elements, shall be marked in the field using survey stakes or similar means at locations shown on the drawings developed by the Aggregate Pier Designer.
- C. Excavations for Obstructions
 - 1. Should any obstruction be encountered during Aggregate Pier installation, the General Contractor shall be responsible for promptly removing such obstruction, or the pier shall be relocated or abandoned. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., which shall prevent placing the piers to the required depth, or shall cause the pier to drift from the required location.
 - 2. Dense natural rock or weathered rock layers shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials.
- D. Utility Excavations

1. The General Contractor shall coordinate all excavations made subsequent to Aggregate Pier installations so that excavations do not encroach on the piers as shown in the Aggregate Pier construction drawings. Protection of completed Aggregate Piers is the responsibility of the General Contractor. In the event that utility excavations are required in close proximity to the installed Aggregate Piers, the General Contractor shall contact the Aggregate Pier Designer immediately to develop construction solutions to minimize impacts on the installed Aggregate Pier elements.

E. Footing Bottoms

1. Excavation and surface compaction of all footings shall be the responsibility of the General Contractor.
2. Foundation and slab on grade excavations to expose the tops of Aggregate Piers shall be made in a workman-like manner, and shall be protected until concrete placement, with procedures and equipment best suited to (1) avoid exposure to water, (2) prevent softening of the matrix soil between and around the Aggregate Piers before pouring structural concrete, and (3) achieve direct and firm contact between the dense, undisturbed Aggregate Piers and the concrete footing.
3. All excavations for footing bottoms and slabs on grade supported by Aggregate Pier foundations shall be prepared in the following manner by the General Contractor.
Recommended procedures for achieving these goals are to:
 - a. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment).
 - b. Compaction of surface soil and top of Aggregate Piers shall be prepared using a motorized impact compactor ("Wacker Packer," "Jumping Jack," or similar). Sled-type tamping devices shall only be used in granular soils and when approved by the designer. Loose or soft surficial soil over the entire footing bottom shall be recompacted or removed, respectively. The surface of the aggregate pier shall be recompacted prior to completing footing bottom preparation.
 - c. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on moisture-sensitive soils. If same day placement of footing concrete is not possible, open excavations shall be protected from surface water accumulation. A lean concrete mud-mat may be used to accomplish this. Other methods must be pre-approved by the Designer.

3.02 APPROVED INSTALLATION PROCEDURES

- A. The following sections provide general criteria for the construction of the Aggregate Piers. Unless otherwise approved by the geotechnical engineer of record and Aggregate Pier Designer, the installation method used for Aggregate Pier construction shall be that as used in the construction of

the successful modulus test.

B. Aggregate Piers Installed using augered systems -

1. Augered pier systems shall be pre-augered using mechanical drilling or excavation equipment.
2. If cave-ins or collapse occurs during excavation such that the sidewalls of the hole are deemed to be unstable, steel casing shall be used to stabilize the cavity or a displacement pier system may be used. The Aggregate Pier Designer and Aggregate Pier Installer shall determine whether a drilled aggregate pier system is appropriate based on subsurface conditions described in the geotechnical engineering report. The Owner does not represent that the subsurface conditions are suitable for use of open hole drilling methods during aggregate pier construction, though open hole methods are permitted if selected by the Aggregate Pier Designer and Aggregate Pier Installer.
3. Aggregate shall be placed in the augered cavity in compacted lift thicknesses no greater than 24 inches as determined by the Aggregate Pier Designer.
4. Should cave-ins occur on top of a lift of aggregate such that the volume of the caved soil is greater than 10 percent of the volume of the aggregate in the lift, then the aggregate shall be considered contaminated and shall be removed and replaced with uncontaminated aggregate.
5. A tamper and high-energy impact densification apparatus shall be employed to densify lifts of aggregate during installation. The tamper diameter shall be at least 80% of the pre-augered hole diameter. The apparatus shall apply direct downward impact energy to each lift of aggregate.

C. Aggregate Piers Installed using displacement aggregate pier systems -

1. Displacement aggregate pier systems shall be constructed by advancing a specially designed mandrel augmented by dynamic vertical ramming energy to the full design depth. The hollow-shaft mandrel, filled with aggregate, is incrementally raised, permitting the aggregate to be released into the cavity, and then lowered by vertically advancing and/or ramming to densify the aggregate and force it laterally into the adjacent soil. The cycle of raising and lowering the mandrel is repeated to the top of pier elevation. The cycle distance shall be determined by the Aggregate Pier Designer.
2. High-energy impact densification apparatus shall be employed to vertically densify the aggregate pier elements during installation of each approximate 1-foot thick constructed lift. The tamper diameter shall be at least 50% of the Aggregate Pier design diameter.
3. Downward crowd pressure shall be applied to the mandrel during installation.

3.03 PLAN LOCATION AND ELEVATION OF AGGREGATE PIERS

- A. The as-built center of each pier shall be within 6 inches of the locations indicated on the plans developed by the Aggregate Pier Designer. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner.

3.04 REJECTED AGGREGATE PIERS

- A. Aggregate Pier elements installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless the Designer approves the condition or provides other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner, unless the cause of rejection is due to an obstruction or mislocation. Contractor to pay for additional engineering required to keep any piers beyond the maximum allowable tolerances.

3.05 QUALITY CONTROL

A. Control Technician

1. The Aggregate Pier Installer shall have a full-time, on-site Quality Control Technician to verify and report all installation procedures. The Aggregate Pier Installer shall immediately report any unusual conditions encountered during installation to the Aggregate Pier Designer, the General Contractor, and to the Testing Agency. The quality control procedures shall include the preparation of Aggregate Pier Progress Reports completed during each day of installation containing the following information:
 - a. Footing and Aggregate Pier location
 - b. Pre-auger diameter and soil conditions encountered during drilling (if required).
 - c. Aggregate Pier length.
 - d. Planned and actual Aggregate Pier elevations at the top and bottom of the Aggregate Pier.
 - e. Average lift thickness of each Aggregate Pier.
 - f. Volume of aggregate used in each Aggregate Pier.
 - g. Documentation of any unusual conditions encountered.
 - h. Type and size of densification equipment used.

B. Aggregate Pier Modulus Test

1. Aggregate Pier Modulus Test(s) shall be performed at locations agreed upon by the Aggregate Pier Designer and the project Geotechnical Engineer of Record to verify or modify Aggregate Pier designs. Modulus Test Procedures shall utilize appropriate portions of ASTM D 1143 and ASTM D 1194, as outlined in the Aggregate Pier design submittal. Aggregate Piers shall be tested to 150 percent of the maximum design top of pier stress as shown in the aggregate pier design submittal. The modulus tests shall be performed in a manner consistent with local standards of practice. Detailed modulus testing procedures shall be included on Aggregate Pier plan sheets prepared by the Aggregate Pier Designer, and shall be approved in advance by the Project Geotechnical Engineer of Record.
2. ASTM D-1143 general test procedures shall be used as a guide to establishing load increments, load increment duration, and load decrements. As a minimum, the following loading increments, decrements and duration shall be used.

INCREMENT	APPROXIMATE LOAD (PERCENT	MINIMUM DURATION (MIN)	MAXIMUM DURATION (MIN)

	DESIGN)		
SEAT	< 9	0	N/A
1	17	15	60
2	33	15	60
3	50	15	60
4	67	15	60
5	83	15	60
6	100	15	60
7	117	60	120
8	133	15	60
9	150	15	60
10	100	N/A	N/A
11	66	N/A	N/A
12	33	N/A	N/A
13	0	N/A	N/A

3. With the exception of the load increment representing approximately 117% of the design maximum top of Aggregate Pier stress, all load increments shall be held for a minimum of 15 minutes. Loads are then maintained until the rate of deflection reduces to 0.01 inch per hour or for the maximum of 1 hour, whichever is occurs first.
4. The load increment that represents approximately 117% of the design maximum stress on the Aggregate Pier shall be held for a minimum of 60 minutes. Loads are then maintained until the rate of deflection reduces to 0.01 inch per hour or for the maximum of 4 hours, whichever is occurs first.
5. A seating load equal to 5 percent of the total load shall be applied to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.
6. The location(s) of the aggregate pier modulus test(s) shall be coordinated with the project Geotechnical Engineer of record to best characterize the nature of the soil conditions encountered.

3.06 PROTECTION

- A. Prior to, during and following Aggregate Pier installation, the Contractor shall provide positive drainage to prevent surface ponding of water.

END OF SECTION 31 3421

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 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

- A. Where the depth of excavation exceeds 20 (twenty) feet the Contractor's shoring systems shall be designed and inspected by a registered professional engineer with experience in the work, all in accordance with federal, state and local safety requirements (the most stringent requirement prevailing).
- B. Where the depth of excavation is less than 20 (twenty) feet, the Contractor shall provide, place and maintain responsibility for shoring, sheeting, bracing, sloping or otherwise support the sides of trenches and excavations, including embankments by a means of sufficient strength to protect employees. Such shoring and associated responsibilities shall be in accordance with federal, state and local safety requirements (the most stringent requirement prevailing).

1.3 SUBMITTAL

- A. For shoring systems to be used for depth of excavation greater than 20 (twenty) feet, submit material indicating compliance with federal, state and local safety requirements for shoring systems. Specifically, the material shall indicate that such systems have been designed by a registered professional engineer with experience in the work.

1.4 COMPETENT PERSON

- A. The Contractor shall be exclusively responsible for providing the services of the Competent Person as referenced in Section 296-155-650 Washington Administrative Code (WAC), relating to excavation, trenching and shoring.
- B. The Contractor shall be exclusively responsible for providing the services of a registered professional engineer for the design of the trench protective system as required in WAC Section 296-155-657.
- C. Representatives of the Owner and Engineer shall not be required to perform the roles of Competent Person or registered professional engineer as defined in WAC 296-155.

PART 2 - PRODUCTS

2.1 SHORING SYSTEMS

- A. Materials used shall be at the Contractor's option.

PART 3 - EXECUTION

3.1 SAFETY REQUIREMENTS

- A. Shoring shall be placed in accordance with federal, state and local safety requirements (the most stringent requirement prevailing)

3.2 SHORING SYSTEMS

- A. Unless otherwise provided, the Contractor shall provide all shoring systems needed to protect the work, adjacent property and improvements, utilities, pavement, etc., and to provide safe working conditions in the trench.
- B. Removal of any or all shoring systems from the trench shall be accomplished in such a manner as to fulfill all of the above requirements and shall also be accomplished in such a manner as to prevent any damage to the work.
- C. Damages resulting from improper shoring or from failure to shore shall be the sole responsibility of the Contractor.
- D. Whether shoring systems shall be left in place or removed shall be at the option of the Contractor, provided that removal of any and all shoring used in trench or structure excavation shall be accomplished in the manner as to prevent the settlement of the pipes or other work and to prevent increased backfill loading which might overload the pipe or walls of the structure.
- E. Shoring shall be removed to a minimum of 5 feet below the final grade.
- F. Should the Owner order that any shoring be left in place, the Contractor shall not remove the same but will receive payment for the materials left in place at the market value thereof.

3.3 SPECIAL REQUIREMENT FOR FLEXIBLE PIPE

- A. Shoring to be removed, or moveable trench shields or boxes, shall be located at least 2 pipe diameters away from the pipe if the bottom of the shoring, shield or box extends below the top of flexible pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by shoring removal can be demonstrated.
- B. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

END OF SECTION 31 50 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt patching.
 - 2. Hot-mix asphalt paving.
 - 3. Hot-mix asphalt overlay.
 - 4. Asphalt curbs.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 3. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or WSDOT.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of WSDOT Standard Specifications for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

1.8 REPAIR AND RESURFACING QUALITY REQUIREMENTS

- A. General: In addition to other specified conditions, comply with following minimum requirements:
 - 1. Comply with requirements of Road Agency having jurisdiction.
 - 2. Provide final surfaces of uniform texture, conforming to required grades and cross-sections.
 - 3. Patches shall match existing grade and cross-section unless otherwise directed by the Road Agency.
 - 4. Unsatisfactory restoration work shall be redone promptly by the Contractor. This includes immediately replacing failed patches.
 - 5. Cleanup of excavation and debris material shall be accomplished concurrently with the burying operation. At no time shall debris and excavation extend along a line for more than three hundred (300) feet.
 - 6. Any temporary restoration work shall be made permanent within thirty (30) calendar days from the date of the temporary restoration.

- B. Surface Smoothness:
 1. Test finished surface of each asphalt concrete course for smoothness, using a 10 foot straight edge applied parallel to and at right angles to centerline of paved areas.
 2. Surfaces will not be acceptable if exceeding 0.25 inch in 10 feet unless more rigid requirements are established by the Road Agency.

1.9 ROAD AND STREET RESTORATION REQUIREMENTS

- A. The Contractor's responsibility as to road restoration shall include, but not be limited to, proper backfill and compaction of excavation, shaping and general restoration of the roadway, restoration of public and private improvements when damaged by construction, restoration of drainage facilities, scarification of existing surfacing, if required, removal of debris and surplus material and all other requirements of these Specifications. In addition, upon completion of the above restoration, backfill gravel or crushed rock shall be placed where required, in the opinion of the Engineer.
- B. Unless otherwise specifically authorized by the authority responsible for the roadway, the final grade and cross-section shall conform to applicable Road Agency standard cross sections. In case of existing private roads, they shall conform to the roadway that existed prior to construction. The removal and disposal of existing materials necessary to fulfill the above requirements shall be considered incidental to the construction and the costs thereof shall be included in the items for which payment is provided.
- C. Manhole rings, valve boxes and monument cases shall be adjusted as necessary to be flush with the restored surface.
- D. The Contractor shall comply with all requirements of all permits for installation of pipelines in authorized right-of-way.
- E. The Contractor will place and maintain sufficient and proper lights and barricades at all locations on roads not accepted by the Road Agency involved.
- F. After completion of pipeline installation the Contractor shall clean up drainage ditches and restore all existing drainage structures that he may have damaged during the course of construction. He shall also comply with all drainage requirements of the agency involved upon which the agency's acceptance of the roads is conditioned.
- G. The Contractor shall restore any private improvement on road right-of-way including, but not limited to, culverts, driveways, curbs, sidewalks, parking strips, parking areas, or other permanent improvements, whether or not a permit for such improvements has been obtained.
- H. On streets where the pipeline is located on the shoulder alongside existing bituminous or concrete surfacing, no payment shall be made for cost of restoring street surfacing which may be damaged by the Contractor's operations.
- I. All streets in the construction area as well as any unpaved streets used by Contractor's trucks or any other equipment hauling material to and from the area, whether within the construction area or adjacent thereto, and any unpaved streets used as detours during the construction shall be serviced with self-propelled pickup street sweepers to prevent the transport of sediment and

other debris off the project site. Street sweepers shall be designed and operated to meet air quality standards

- J. It is specifically understood and agreed that the Contractor is responsible for complying with all requirements of the Road Agency necessary to obtain written acceptance of the roads by the agency concerned, and for such work the Contractor will be paid only for the items included in this Contract.
- K. Until accepted in writing by the Road Agency, the Contractor will maintain all roads in a condition satisfactory to the agency concerned. This shall include periodic grading of all streets on which traffic is allowed wherever in the opinion of the Engineer, such grading is required. A suitable motor grader shall be available for this work.
- L. Any settlement which occurs during the first year after final contract acceptance shall be repaired by the Contractor at his expense.

PART 2 - PRODUCTS

2.1 CRUSHED ROCK

- A. Crushed rock shall be as specified in Section 31 20 00.

2.2 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse and Fine Aggregate: Materials conforming to WSDOT Standard 9-03.8.
- C. Mineral Filler: Material conforming to WSDOT Standard 9-03.8(5).

2.3 ASPHALT MATERIALS

- A. Asphalt Binder: Material conforming to WSDOT Standard 9-02.1(4).
- B. Asphalt Cement: ASTM D 3381/D 3381M for viscosity-graded material
- C. Emulsified Asphalt Prime Coat: Material conforming to WSDOT Standard 9-02.1(6).
- D. Tack Coat: Material conforming to WSDOT Standard 9-02.1(6).
- E. Water: Potable.
- F. Undersealing Asphalt: ASTM D 3141/D 3141M; pumping consistency.

2.4 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled asphalt shingles from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Joint Sealant: Material conforming to WSDOT Standard 9-04.2

2.5 MIXES

- A. Surface Course Limit: Recycled content no more than 20 percent by weight.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by WSDOT and complying with the following requirements:
 - 1. WSDOT Standard Specifications Section 5-04
 - 2. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 3. Base Course: Class ½" PG 64-22
 - 4. Surface Course: Class ½" PG 64-22

2.6 ASPHALT TREATED BASE

- A. Asphalt treated base shall conform to the Technical Requirements of the WSDOT Standard Specifications for asphalt treated base unless superseded by the local Road Agency.

2.7 PAVEMENT MARKINGS

- A. Striping shall be high VOC solvent based paint per WSDOT Standard Specification 9-34.
- B. Crosswalks and stop bars shall be Type B – Preformed Fused Thermoplastic per WSDOT Standard Specification 9-34.

2.8 CONCRETE

- A. Concrete specifications shall meet the requirements of the local Road Agency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below 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, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 GENERAL PAVEMENT REPAIR REQUIREMENTS

- A. Pavement patching shall be scheduled to accommodate the demands of traffic and shall be performed as rapidly as possible to provide maximum safety and convenience to public travel.
- B. The placing and compaction of the trench backfill, and the preparation and compaction of the subgrade shall be in accordance with the requirements of Section 31 20 00 of these Specifications.
- C. Prior to trench excavation in pavement surfaces, straight vertical trim lines shall be saw cut in order to minimize breakage and cracking of the remaining surfacing.
- D. Before the patch is constructed all pavement cuts shall be trued so that the marginal lines of the patch will form a rectangle with straight edges and vertical faces.
- E. After completion of the patches, the entire roadway surface shall be cleaned by brooming or such other methods as may be required. The early completion of this phase of the restoration is required, not only to facilitate public relations, control dust and traffic problems, but also to prevent the further break-up and cracking of the existing asphalt mat. If, in the opinion of the Engineer, the Contractor is not diligently pursuing the work in such a manner as to place the patch as soon as reasonably possible, the Contractor may be required to re-trim and remove any and all cracked areas in such a manner to produce a straight uniform edge.
- F. Finished grade and cross section of patch shall match grade and cross-section of existing pavement.
- G. All incidental work required to complete the patching of street surfaces as specified, including joints where required, shall be considered as incidental to the patching and the costs thereof shall be included in the items for which payment is provided.

3.3 TEMPORARY TRENCH PATCH

- A. The Contractor may be required to furnish and install a temporary trench patch only when specifically directed by the Owner or as provided on the Plans.
- B. Area to be patched shall be cleaned out and graded to the bottom of the base course. Any loose asphalt shall be removed.
- C. Place a patch consisting of 2-inch minimum course of crushed rock base and a 2-inch minimum course of cold asphalt plant mix placed over the trench area.
- D. Both the base and surface course shall be placed and compacted so that the finished surface will match the grade and cross-section of the existing pavement.
- E. Surface of pavement shall be cleaned of all dirt and debris before opening to traffic.
- F. The Contractor shall maintain temporary patch until the permanent patch is installed

3.4 ASPHALT CONCRETE PAVEMENT PATCH

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompect existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Before placing patch material, the following shall be performed.
 - 1. A tack coat of asphalt applied at the rate of 0.02 to 0.08 gallon per square yard of retained asphalt shall be applied through the use of mechanical equipment to all surfaces on which any course of asphalt concrete is to be placed or abutted. The spreading equipment shall be capable of uniformly distributing asphalt materials over any area in controlled amounts and shall be equipped with hand operated spray equipment for use only on inaccessible and irregularly shaped areas.
 - 2. The tack coat shall be a heated cutback asphalt, or emulsified asphalt, mixing grade. The emulsified asphalt may be mixed with water at the rate of 1 to 2 parts water to 1 part of emulsified asphalt.
 - 3. If a temporary trench patch has been used it shall be removed and disposed of properly.
 - 4. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 5. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Placing Patch Material: After the subgrade has been properly prepared and compacted, a minimum of two inches of Hot Mix Asphalt shall be placed and compacted. Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. If the existing pavement is more than two inches thick, asphalt concrete shall be of the same depth as existing

pavement prior to construction. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

- D. The asphalt concrete pavement shall then be placed, leveled, and compacted to conform to established cross-section and grade and to match adjacent paved surface.
- E. The edge of the new pavement shall be sealed by painting with a cutback asphalt or CSS-1 emulsion and immediately covered with sand and heated.

3.5 RIGID TYPE PAVEMENT RESURFACED WITH ASPHALT CONCRETE

- A. Cement concrete patch shall be placed as specified for cement concrete pavement patch except that the surface of the cement concrete portion of the patch shall be left low enough to accommodate the asphalt portion of the patch. Brush finishing will not be required.
- B. Curing shall be accomplished with an asphalt emulsion cut back with water.
- C. Asphalt concrete or bituminous plant mix shall not be placed until the day after the cement concrete has been placed.
- D. The edges of the existing asphalt pavements and castings shall be painted with hot asphalt cement or asphalt emulsion immediately before placing the asphalt patching material.
- E. The asphalt concrete pavement shall then be placed leveled and compacted to conform to the adjacent paved surface.
- F. All joints between the new and original asphalt pavement shall be painted with hot asphalt or asphalt emulsion and be covered with dry paving sand before the asphalt solidifies.

3.6 ASPHALT CONCRETE CURBS AND GUTTERS

- A. Placed, shaped and compacted true to line and grade, with machine capable of shaping and compacting the materials, to the required cross-section.
- B. Provide tack coat of asphalt applied to the surface upon which asphalt concrete curb is to be placed immediately prior to placing of curb.

3.7 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.

2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.8 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials. Comply with WSDOT Standard 5-04.3(4)B.
 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth (0.5 to 1.40 L/sq. m per 25 mm depth). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Prepare existing surfaces according to WSDOT Standard 5-04.3(4). Sawcut all edges. Apply uniformly to surfaces of existing pavement at a rate of 0.05 gal./sq. yd. (0.2 L/sq. m) or as required by manufacturer.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.9 ASPHALT CONCRETE OVERLAY

- A. Before construction of an asphalt concrete pavement overlay on an existing surface, all fatty asphalt patches, grease drippings, and other objectionable matter shall be removed from the existing pavement. Excess asphalt joint filler shall be removed and pre-molded joint filler shall be removed to at least 1/2 inch below the surface of the existing pavement. Existing pavement or bituminous surfaces shall be thoroughly cleaned by sweeping to remove dust and other foreign matter.
- B. Prior to placing asphalt concrete, a tack coat shall be applied using heated cut back asphalt or emulsified asphalt at the rate of 0.02 to 0.05 gallons per square yard.
- C. When the surface of the existing pavement or old base is irregular, it shall be brought to uniform grade and cross section as required by the Road Agency involved. Pre-leveling of uneven or broken surfaces over which asphalt concrete is to be placed is required and may be

accomplished by the use of asphalt concrete placed with a motor patrol grader, a paving machine, by hand raking, or by a combination of these methods. After placement, the asphalt concrete used for pre-leveling shall be compacted with rollers.

- D. When asphalt concrete pavement is to be constructed over an existing paved or oiled surface, in addition to the preparation as outlined hereinbefore, all holes and small depressions shall be filled with an appropriate class of asphalt concrete mix. The surface of the patched area shall be leveled and compacted thoroughly. All previous patches that have settled shall be pre-leveled so that depth of overlay does not exceed two inches in thickness.
- E. After preparation of the base a one-inch minimum compacted full width layer of asphalt concrete shall be placed on top of an existing paving surface. Surfacing shall be placed in such a manner as to prevent disturbing existing drainage. Surfacing shall be feathered out as required to meet existing driveways, catch basins, traffic control pads, street intersections, etc., and shall include thickened edge paving where it is now existing.
- F. The edges of the overlay shall be sealed by painting with a cutback asphalt or CSS-1 emulsion and immediately covered with dry sand and heated.

3.10 PAVING GEOTEXTILE INSTALLATION

- A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).
- C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.11 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at a minimum temperature in accordance with the mix design.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.12 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.13 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.14 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch (13 mm).
 - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Pavement Surface Smoothness: Conform to WSDOT Standard 5-04.3(13).

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.16 PAVEMENT MARKINGS

- A. Install pavement markings per WSDOT Standard Specification 8-22.
- B. The Contractor shall restore any and all reflective and non-reflective pavement striping and traffic buttons damaged during construction under this Contract.
- C. Restoration shall be in accordance with the current standards of the Road Agency involved.
- D. Prior to installing pavement markings the Contractor shall pre-mark the layout of all channelization and receive approval from the Engineer. Pre-marks shall consist of painted spot markings. The Contractor shall notify the Engineer of his/her intention to receive approval of the pre-mark channelization at least 48 hours in advance.

3.17 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan.

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes the following:
 - 1. Curbs and gutters
 - 2. Walks
 - 3. Flush Paving

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.
 - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 2. Require representatives of each entity directly concerned with concrete paving 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 paving Subcontractor.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- B. Field quality-control reports.
- C. Qualifications of Quality Assurance Control personnel responsible for concrete consistency, strength, air content and all testing.
- D. Trip tickets for each load of concrete indicating weights of all materials and additives.

1.7 QUALITY ASSURANCE

- A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- B. Ready-Mix-Concrete 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: 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.
- D. Delivery: Furnish a certificate with each truckload of concrete product delivered to the site, indicating the composition and quality of the mix. Include size and weight of each aggregate, amount of cement, amount of water and amount and kind of any additives included in the concrete.
- E. Standards: All current and applicable standards of the following:
 - 1. American Concrete Institute – ACI 318

2. Concrete Reinforcing Steel Institute CRSI
 3. IBC
 4. Other local codes or criteria noted on drawings.
- F. Concrete consistency:
1. Test each truckload of concrete for slump. Calibrate each mixer or haul unit to be used by measuring slump near the beginning and near the end of the discharge cycle. Mix units determined by the Engineer to be deficient in mixing capability shall not be used in subsequent deliveries. Slump testing procedures shall be per ASTM C143.
 2. Consistency shall be per values below with tolerance of ± 1 inch.
 - a. 3 inches maximum slump
- G. Concrete test cylinders:
1. Prepare a minimum of three test cylinders for each location (slab, wall, column, beam, etc.) for each day's placement or each 50 cu. yd., whichever is greater.
 2. Test set of 3 cylinders as follows:
 - a. One at 7 days.
 - b. Two at 28 days.
 3. Prepare and test cylinders per ASTM C31 and C39.
- H. Prior to placement, have available at placement location all tools, cylinder molds, slump cone, rod, curing containers and all other apparatus required for sampling and testing.
- I. Air-entrained: One test for each mix design.
- J. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
 2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Engineer and not less than 96 inches (2400 mm) by 96 inches (2400 mm). Include full-size detectable warning surface.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, any steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

1.10 ROAD AND STREET RESTORATION REQUIREMENTS

- A. The Contractor's responsibility as to road restoration shall include, but not be limited to, proper backfill and compaction of excavation, shaping and general restoration of the roadway, restoration of public and private improvements when damaged by construction, restoration of drainage facilities, scarification of existing surfacing, if required, removal of debris and surplus material and all other requirements of these Specifications. In addition, upon completion of the above restoration, backfill gravel or crushed rock shall be placed where required, in the opinion of the Engineer.
- B. Unless otherwise specifically authorized by the authority responsible for the roadway, the final grade and cross-section shall conform to applicable Road Agency standard cross sections. In case of existing private roads, they shall conform to the roadway that existed prior to construction. The removal and disposal of existing materials necessary to fulfill the above requirements shall be considered incidental to the construction and the costs thereof shall be included in the items for which payment is provided.
- C. Manhole rings, valve boxes and monument cases shall be adjusted as necessary to be flush with the restored surface.
- D. The Contractor shall comply with all requirements of all permits for installation of pipelines in authorized right-of-way.
- E. The Contractor will place and maintain sufficient and proper lights and barricades at all locations on roads not accepted by the Road Agency involved.

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- F. After completion of pipeline installation the Contractor shall clean up drainage ditches and restore all existing drainage structures that he may have damaged during the course of construction. He shall also comply with all drainage requirements of the agency involved upon which the agency's acceptance of the roads is conditioned.
- G. The Contractor shall restore any private improvement on road right-of-way including, but not limited to, culverts, driveways, curbs, sidewalks, parking strips, parking areas, or other permanent improvements, whether or not a permit for such improvements has been obtained.
- H. On streets where the pipeline is located on the shoulder alongside existing bituminous or concrete surfacing, no payment shall be made for cost of restoring street surfacing which may be damaged by the Contractor's operations.
- I. All streets in the construction area as well as any unpaved streets used by Contractor's trucks or any other equipment hauling material to and from the area, whether within the construction area or adjacent thereto, and any unpaved streets used as detours during the construction shall be serviced with self-propelled pickup street sweepers to prevent the transport of sediment and other debris off the project site. Street sweepers shall be designed and operated to meet air quality standards.
- J. It is specifically understood and agreed that the Contractor is responsible for complying with all requirements of the Road Agency necessary to obtain written acceptance of the roads by the agency concerned, and for such work the Contractor will be paid only for the items included in this Contract.
- K. Until accepted in writing by the Road Agency, the Contractor will maintain all roads in a condition satisfactory to the agency concerned. This shall include periodic grading of all streets on which traffic is allowed wherever in the opinion of the Engineer, such grading is required. A suitable motor grader shall be available for this work.
- L. Any settlement which occurs during the first year after final contract acceptance shall be repaired by the Contractor at his expense.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less.

2. Notched, bent, or otherwise warped forms shall not be acceptable unless authorized by Engineer.
 3. Forms shall possess sufficient strength to resist all loads applied in the paving process without visible springing or other adverse movement.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars; assembled with clips.
- B. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 1. Portland Cement: Conforms to WSDOT Specifications Section 9-01.2(1).
 2. Fly Ash: Conforms to WSDOT Specifications Section 9-23.9.
 3. Slag Cement: Conforms to WSDOT Specifications Section 9-23.10.
 4. Blended Hydraulic Cement: Conform to WSDOT Specifications Section 9-01.2(1)B.
- B. Normal-Weight Aggregates: Conform to WSDOT Specifications Section 9-03 and subsections.
- C. Exposed Aggregate: Conform to WSDOT Specifications Section 9-03 and subsections.
- D. Air-Entraining Admixture: Conform to WSDOT Specifications Section 9-23.6(1).
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material. All admixtures shall conform to WSDOT Specifications Section 9-23 and respective subsections.
- F. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 1. Color: As indicated by Architect.
- G. Water: Potable and conforming to WSDOT Specifications Section 9-25.1.

2.5 CURING MATERIALS

- A. General: Curing materials shall conform to WSDOT Specifications Section 9-23 and respective subsections.

- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable and conforming to WSDOT Specifications Section 9-25.1.

2.6 RELATED MATERIALS

- A. Joint Fillers: Conform to WSDOT Specifications Section 9-04.1(2).

2.7 STAMPED DETECTABLE WARNING MATERIALS

- A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
 - 1. Surfaces shall conform to WSDOT Specifications Section 9-19.
- B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience. Design mixes shall conform to WSDOT Standard 5-05.3(1).
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Slag Cement: 50 percent.
 - 3. Combined Fly Ash and Slag Cement: 50 percent
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5.5 percent plus or minus 1-1/2 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- G. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 4500 psi
 - 2. Maximum W/C Ratio at Point of Placement: 0.45
 - 3. Slump Limit: 3 inches (100 mm), plus or minus 1 inch (25 mm).

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Mix and deliver in accordance with WSDOT Specifications Sections 6-02.3(4), 6.02.3(4)A, and 6.02.3(4)B.
 - 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.
- B. Project-Site Mixing: Mix in accordance with WSDOT Specifications Sections 5-05.3(5) and 5-05.3(5)A.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 GENERAL PAVEMENT REPAIR REQUIREMENTS

- A. Pavement patching shall be scheduled to accommodate the demands of traffic and shall be performed as rapidly as possible to provide maximum safety and convenience to public travel.
- B. The placing and compaction of the trench backfill, and the preparation and compaction of the subgrade shall be in accordance with the requirements of Section 31 20 00 of these Specifications.
- C. Prior to trench excavation in pavement surfaces, straight vertical trim lines shall be saw cut in order to minimize breakage and cracking of the remaining surfacing.
- D. Before the patch is constructed all pavement cuts shall be trued so that the marginal lines of the patch will form a rectangle with straight edges and vertical faces.
- E. After completion of the patches, the entire roadway surface shall be cleaned by brooming or such other methods as may be required. The early completion of this phase of the restoration is required, not only to facilitate public relations, control dust and traffic problems, but also to prevent the further break-up and cracking of the existing asphalt mat. If, in the opinion of the Engineer, the Contractor is not diligently pursuing the work in such a manner as to place the patch as soon as reasonably possible, the Contractor may be required to re-trim and remove any and all cracked areas in such a manner to produce a straight uniform edge.
- F. Finished grade and cross section of patch shall match grade and cross-section of existing pavement.
- G. All incidental work required to complete the patching of street surfaces as specified, including joints where required, shall be considered as incidental to the patching and the costs thereof shall be included in the items for which payment is provided.

3.4 CEMENT CONCRETE PAVEMENT PATCH

- A. After the subgrade for the pavement has been compacted and constructed to line and grade, the cement concrete pavement patch shall be placed, compacted and struck off to the grade of the adjacent pavement.
- B. Minimum thickness shall be eight inches or the thickness of the existing pavement plus two inches, whichever is greater.
- C. Through and dummy joints shall be placed and edged to match existing joints.
- D. The surface shall be finished and brushed with a fiber brush.
- E. Approved curing compound shall be placed on the finished concrete immediately after finishing.
- F. Concrete used in patches shall be in accordance with the requirements of the local Road Agency.

3.5 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides 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. Design formwork to safely support vertical and lateral loads which might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads by formwork system to the ground or to in-place construction which has attained adequate strength for that purpose.
- C. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, and height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- D. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- E. Form facing materials shall be supported by structural members spaced to prevent deflection. Design camber in formwork as required for anticipated deflections.
- F. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent material.
- G. Keep oil or other agents from getting on reinforcing steel, embedded items, or other surfaces requiring bond with concrete.
- H. Form ties construction shall be in accordance with Section 4.4 of ACI 350 R-01.
- I. Formwork General:
 - 1. Before concrete is placed in any form, verify horizontal and vertical form position and correct all inaccuracies. Complete all wedging and bracing in advance of placing of concrete.
 - 2. When setting form ties, no metal shall be within one inch of any surface. Ties shall fit tightly to prevent mortar leakage at holes in forms. Ties shall be protected from rusting at all times. No wire ties or wood spreaders will be permitted. Cutting ties back from concrete face will not be permitted.
 - 3. At each construction joint, stabilize forms by using an adequate number of form ties for each new pour. Formwork and/or ties shall not be continuous across the joint. All construction joints shall be horizontal or vertical.
 - 4. For exposed concrete, forms shall be of new plywood, metal panel, or approved panel materials, smooth, and continuous.
 - 5. For unexposed concrete, forms shall be plywood, metal, boards, or approved material. Boards: nominal one inch minimum thickness, sound and tight, commercial construction lumber, shiplap or tongue-and-grooved, dressed on at least one side and both edges for tight fit; plywood, metal, or approved material equal to or better than board surface.
- J. Camber: Forms for girders and slabs cambered unless otherwise noted.

DIVISION 32 EXTERIOR IMPROVEMENTS

- K. Chamfered Corners: All corners chamfered 3/4 inch, unless shown otherwise on drawings. Provide 45 degree triangular moldings in forms for all chamfering required.
- L. Inspection and Cleanout Openings: Provide inspection and cleanout openings at the bottom of all forms for columns, pilasters, walls over 8 feet in height, and for forms for irregularly shaped placement where cleaning and inspection from the top would be impractical.
- M. Coordination: Coordinate the installation of all items to be inserted or embedded in concrete. Support all items to maintain accurate alignment and prevent distortion during concrete placement.
- N. Cleaning: All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms, or within the excavated areas before any concrete is deposited therein.
- O. Any form movement or deflection during construction or finished surface variations in excess of the tolerances specified will be basis for rejection of cast-in-place product and requirement for replacement of same.
- P. Do not remove forms and supports until concrete has attained sufficient strength to support anticipated loads.
- Q. The listing below serves only as a guide in determining the minimum length of time required before removal of forms and is based on the use of Type I Portland Cement. When high early strength Portland cement is used, the length of time listed below may be reduced to not less than one third time listed, but not less than 1 day.
 - 1. Walls in mass work--24 hours
 - 2. Thin walls (12 inches or less) and sides of beams and girders--48 hours
 - 3. Columns--7 days
 - 4. Bottom forms and supports of beams, girders and slabs--14 days
- R. Use methods of form removal which will not cause overstressing of the concrete. Remove supports to permit the concrete to uniformly and gradually take the stress due to its own weight. Do not use high impact methods to remove supports.
- S. Break back ties after concrete has cured sufficiently to maintain unbroken bond with steel rod.
- T. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.
- U. Any reused form for exposed concrete work shall be reconditioned to "like new" condition. Any reused form shall be cleaned, repaired, and recoated before each reuse.
- V. Where pipes, castings, or conduits pass through the walls, place such pipes or castings in the forms before pouring the concrete, or in special cases, with the express consent of the Engineer or as specified, build accepted boxes in the forms to make cored openings for subsequent insertion of such pipes, castings or conduits. Provide boxes or cores with continuous keyways and water stop all the way around, and with slight flare to facilitate grouting and the escape of entrained air during grouting.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, 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 reinforcement 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 of adjacent mats.

3.7 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 (ACI 301M) and WSDOT Specifications Section 5-05 requirements for measuring, mixing, transporting, and placing concrete. Cement Concrete Sidewalks shall conform to WSDOT Specifications Section 8-14.

- E. Protect concrete slopes in accordance with WSDOT Specifications Section 8-16.
- F. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement and joint devices.
- I. Screed paving surface with a straightedge and strike off.
- J. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- K. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- L. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.9 CEMENT CONCRETE SIDEWALKS

- A. The concrete in the sidewalks shall be air entrained concrete in accordance with the requirements of the WSDOT Standard Specifications Section 8-14.
- B. Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be straight, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.
- C. The foundation shall be brought to the grade required and well wetted before placing the concrete.
- D. Place concrete in the forms and strike off with a heavy iron shod straight edge, trowel surface smooth with a steel trowel as soon as surface can be worked. After troweling and before jointing or edging, the surface of the walk shall be lightly brushed in a transverse direction with a soft brush. On grades of over 4%, the surface shall be finished with a stipple brush.
- E. Joints shall be constructed at the locations and of the sizes as required by the Road Agency.

- F. Cured for at least 72 hours by means of moist burlap or quilted blankets. Exclude all traffic, both pedestrian and vehicular, during curing period.

3.10 CEMENT CONCRETE CURBS AND GUTTERS

- A. The concrete in the curbs and gutters shall be air entrained concrete in accordance with the requirements of the WSDOT Standard Specifications for Road Bridge and Municipal Construction Section 8-14 (current edition).
- B. Side forms shall rest throughout their length on firm ground and shall be full depth of the curb. They shall be either metal of suitable gauge for the work or surfaced "construction" grade lumber not less than two (2) inches (commercial) in thickness. Forms shall be cleaned and well oiled prior to use. Forms used more than one time shall be cleaned thoroughly and any forms which have become worn, splintered, or warped shall not be used again. Forms shall be adequately supported to prevent deflection or movement.
- C. The foundation shall be watered thoroughly before the concrete is placed.
- D. Concrete shall be well tamped and spaded or vibrated in the forms.
- E. Exposed surfaces shall be finished full width with a trowel and edger. Remove forms of all roadway face of curbs within 24 hours of placement of concrete and treat with a float finish. The curb and gutter finish shall meet the Road Agency requirements.
- F. Joints shall be spaced to match joints in the abutting pavement. If the abutting pavement is not jointed or the curb or gutter is not abutting pavement, joints in the curb and gutter shall be spaced at 15 foot intervals. These joints shall be 1/8 inch minimum thickness and constructed to a minimum depth of 1 inch by sawing or scoring with a tool which leaves the corners rounded and destroys aggregate interlock to a depth specified. Expansion joints, filled to full cross-section with filler 1/4 inch thick shall be placed in the curb and gutter to match joints in the abutting pavement, at structures, curb returns and where shown in the plans.
- G. Cure for 72 hours by method acceptable to Road Agency.
- H. Curb and gutter may be constructed by the use of slip form equipment provided the completed curb or gutter retains its shape, grade, and line. Finishing, joints, and curing shall be as provided above.
- I. Top of the form shall not depart from grade more than 1/8 inch when checked with a 10 foot straight edge. Alignment shall not vary more than 1/4 inch in 10 feet.

3.11 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true

planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.12 DETECTABLE WARNING INSTALLATION

- A. Blockouts: Form blockouts in concrete for installation of detectable paving units.

1. Tolerance for Opening Size: Plus 1/4 inch (6 mm), no minus

- B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles. Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with WSDOT Standard Specifications.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- B. Comply with ACI 306.1 for cold-weather protection.

- C. Evaporation Retarder: Apply evaporation retarder to 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.

- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

- E. Curing Methods: Cure concrete by moisture-retaining-cover curing as follows:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3.14 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

1. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
2. Surface: Gap below 10-feet- (3-m-) long; unlevelled straightedge not to exceed 1/2 inch (13 mm).
3. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
4. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).

5. Vertical Alignment of Dowels: 1/4 inch (6 mm).
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
7. Joint Spacing: 3 inches (75 mm).
8. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
9. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting 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 at least one composite sample for each 100 cu. yd. (76 cu. m) 5000 sq. ft. (465 sq. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide 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; 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 and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if 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).
- D. Test results shall be reported in writing to Engineer, 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.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

- F. 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 Engineer.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.16 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.
- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.17 UNSATISFACTORY CONCRETE

- A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the Contractor's expense.
- B. Method of determining unsatisfactory concrete: Visual appearance characteristic of rain or freeze damage to concrete which is apparent to the Engineer.

END OF SECTION 32 13 13

SECTION 32 1723 - PAVEMENT MARKINGS

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 painted markings applied to **asphalt and concrete** pavement.

1.3 REFERENCES

- A. Comply with the requirements of:
 - 1. FS TT-P-115E Paint, Traffic, Highway, White, Yellow and Red.
 - 2. ANSI D6.1 Manual on Uniform Traffic Control Devices For Streets and Highways, latest edition.
 - 3. WSDOT Standard Specifications for Road Bridge and Municipal Construction, latest edition, Section 9-34.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.
 - 1. Review methods and procedures related to marking pavement including, but not limited to, the following:
 - a. Pavement aging period before application of pavement markings.
 - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
 - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

- C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of **WSDOT** for pavement-marking work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

- A. Comply with “Quality Assurance” provisions, “References”, Specifications and Manufacturer’s data. Where these may be in conflict, the more stringent requirements govern.
 - 1. Products to be;
 - a. Factory mixed, quick drying; non-bleeding synthetic traffic paint conforming to referenced WSDOT Standard Specifications, Section 9-34
 - 1) Alkyd base paints.
 - b. Thermoplastic per WSDOT Standard Specifications Section 9-34.

2.2 ACCEPTABLE MANUFACTURERS AND PRODUCTS

- A. Alkyd:
 - 1. Sherwin-Williams Pro-Mar B29 Series Traffic Marking Paint.
 - 2. Benjamin Moore & Co. M56 Moore’s Safety and Zone Marking Alkyd.
 - 3. Preservative Paints No. 33-582 and 33-687.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age per the manufacturer's recommendations.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness per WSDOT standards.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
 - 2. Broadcast glass beads uniformly into wet markings at a rate per WSDOT standards.

3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 1723

SECTION 32 1726 - TACTILE WARNING SURFACING

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. Cast-in-place detectable warning tiles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.6 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Adhesive Application:
 - 1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.
- C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
 - a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F , set unit pavers within 1 minute of spreading setting-bed mortar.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering and wear.
 - b. Separation or delamination of materials and components.
 2. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.
 1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. Source Limitations: Obtain each type of tactile warning surfacing, joint material, setting material, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
 1. Material: **Molded glass- and carbon-fiber-reinforced polyester.**
 2. Color: **As selected by Architect from manufacturer's full line.**
 3. Shapes and Sizes: As required for application.

4. Dome Spacing and Configuration: **Manufacturer's standard compliant spacing in manufacturer's standard** pattern.
5. Mounting:
 - a. Detectable warning tile set into formed recess in concrete and adhered.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
 1. Furnish **Type 304** stainless-steel fasteners for exterior use.
 2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.
- B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.
- C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles:
 1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.

2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.4 CLEANING AND PROTECTION

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 32 3113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operation.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

- E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Product Certificates: For each type of chain-link fence and gate.
- C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates serving as a required means of access.

1.7 FIELD 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

- c. Faulty operation of gate controls.
- 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design chain-link fence and gate frameworks.
- B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
 - 1. Design Wind Load: Verify with local authority.
 - a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 8 feet.
- C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 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 according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings. 7' heights in project.
 - 2. Steel Wire for Fabric: Wire diameter of 0.148 inch.
 - a. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft.
 - b. Polymer-Coated Fabric: ASTM F 668, Class 2a or Class 2b over Zn-5-Al-MM-alloy-coated steel wire.
 - 1) Color: Black, according to ASTM F 934.
 - c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
 - d. Mesh Size: 2" maximum typical
 - 1) 3/8" where indicated.
 - 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
1. Fence Height: Project includes 72 inches and 96 inches, as indicated on Drawings.
 2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 2.375 inches in diameter
 - b. End, Corner, and Pull Posts: 2.875 inches in diameter
 3. Horizontal Framework Members: Top rails according to ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.
 4. Brace Rails: ASTM F 1043.
 5. Metallic Coating for Steel Framework:
 - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
 6. Polymer coating over metallic coating.
 - a. Color: Black, according to ASTM F 934.

2.4 SWING GATES

- A. General: ASTM F 900 for gate posts and single swing gate types.
1. Gate Leaf Width: As indicated in plans.
 2. Framework Member Sizes and Strength: Based on gate fabric height of 72 inches and 96 inches as indicated.
- B. Fencing fabric shall match finish of main fabric. Provide the following mesh sizes:
1. Fabric for Swing Gates: 2" security mesh.
- C. Pipe and Tubing:
1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
 2. Gate Posts: Round or rectangular tubular steel.
 3. Gate Frames and Bracing: Round or rectangular tubular steel.
- D. Frame Corner Construction: Welded.

- E. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend 12 inches above top of chain-link fabric at both ends of gate frame to attach barbed wire assemblies.
- F. Hardware:
 - 1. Hinges: **360-degree inward and outward** swing.
 - 2. Latch: Permitting operation from both sides of gate **with provision for padlocking accessible from both sides of gate.**
 - 3. Padlock and Chain: To be provided by owner.
 - 4. Closer:.
 - 5. Provide tubing in ground and hold open rods on both leaves of gate. .

2.5 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive 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 6 inches long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 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. Bottom Rail: Same as top rail. Tension wires not allowed for bottom rail.
- H. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- I. Barbed Wire Arms: Pressed steel or cast iron with clips, slots, or other means for attaching strands of barbed wire integral with post cap, for each post unless otherwise indicated, and as follows:
 - 1. Provide line posts with arms that accommodate top rail.
 - 2. Double-Arm Type: V shaped.
- J. 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, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

K. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
 - a. Finish per plans. Black vinyl coated and galvanized.

2.6 BARBED WIRE

- A. Galvanized-Steel Barbed Wire: Three-strand barbed wire, 0.080-inch- diameter line wire with 0.080-inch- diameter, four-point, round galvanized-steel barbs spaced not more than 5 inches o.c.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. 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.

2.8 GROUNDING MATERIALS

- A. Comply with requirements in electrical specifications.
- B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 1. Connectors for Below-Grade Use: Exothermic welded type.
 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. 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 minimum dimensions of 24" deep and 12" in diameter.** Vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Place top of concrete 2 inches below grade to allow covering with surface material.
 - c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at 8 feet o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. 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 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. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. 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.
- H. Intermediate and Bottom Rails: Secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts and rails. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- M. Barbed Wire: Install barbed wire uniformly spaced, angled both ways away from fencing.. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

3.4 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.

3.5 GROUNDING AND BONDING

- A. Comply with requirements in electrical specifications.
- B. Fence and Gate Grounding:
 1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
 2. Install ground rods and connections at maximum intervals of 1500 feet .

3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
 4. Ground fence on each side of gates and other fence openings.
 - a. Bond metal gates to gate posts.
 - b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
 - C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.
 - D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.
 - E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
 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.
 - F. Connections:
 1. Make connections with clean, bare metal at points of contact.
 2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 4. Make above-grade ground connections with mechanical fasteners.
 5. Make below-grade ground connections with exothermic welds.
 6. 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: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.
 - H. Comply with requirements in in electrical specifications.
- 3.6 FIELD QUALITY CONTROL
- A. Testing Agency: Owner will engage a qualified testing agency to perform tests.
 - B. Grounding Tests: Comply with requirements in electrical specifications
 - C. Prepare test reports.

3.7 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. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 32 3119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete for concrete post concrete fill.
 - 2. Division 32 Section "Chain Link Fences and Metal Gates" for connecting fences.
 - 3. Division 08 Section "Door Hardware" for pedestrian gate hardware.
 - 4. Electrical plans for electrical service and connections for motor operators, controls, limit and disconnect switches, and safety features and for system disconnect switches.

1.2 SUMMARY

- A. Section Includes: Provide all labor, materials and appurtenances necessary for installation of the welded ornamental steel fence system defined herein for alternate fencing type. Components include:
 - 1. Decorative metallic-coated steel tubular picket fences.
 - 2. Swing gates (pedestrian and vehicle).
 - 3. Telescoping sliding gate
- B. System Description: Supply a total fence system of Ameristar Montage II design. The system shall include all components (i.e., panels, posts, gates and hardware) required.

1.3 PERFORMANCE REQUIREMENTS

- A. Reference Standards: Comply with the following:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
 - 3. ASTM D523 - Test Method for Specular Gloss.
 - 4. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
 - 5. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
 - 6. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
 - 7. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 8. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 9. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

10. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated including but not limited to: fencing, gates, operators/controls, finish system, connectors, accessories, and hardware.
- B. Shop Drawings: For fences and gates - include plans, elevations, sections, details, and attachments to other work. Drawings indicate design intent sizes and profiles. Manufacturer or fabricator shall engage a qualified engineer to design and confirm Architect's detailing.
 - 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: Power and control wiring and communication features and access control features. Differentiate between manufacturer-installed and field-installed wiring and between components provided by gate operator manufacturer and those provided by others.
- C. Structural Calculations: **Submit structural calculations performed by a qualified engineer for fencing and gates including fence with wire mesh security fabric.**
- D. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.
 - 2. Provide Samples 12 inches square for wire mesh, bar grating and sheet or plate materials.
- E. Welding certificates.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for decorative metallic-coated steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.
- G. Operations and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
 - 1. Polymer finishes.
 - 2. Gate Operator
 - 3. Gate Hardware
- H. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Use installers who are trained and familiar with the product, with a record of successful installation decorative metal fences and gates and who are approved by the manufacturer for installation of the system.

- B. Welding Qualifications: Qualify procedures and personnel conducting field welding according to AWS D1.1/D1.1M, "Structural Welding Code – Steel or AWS D1.2/D1.2M, "Structural Welding Code – Aluminum as applies."
- C. Source Limitations for Ornamental Fences and Gates: Obtain each color, grade, finish, type, and variety of component for ornamental fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.
- D. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gate operators on gates that must provide emergency access.
 - 1. Provide key box for Fire Department access. Coordinate exact product requirements and location with the AHJ.
 - 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer and Installer agrees to repair or replace components of decorative metal fences and gates that fail in materials or workmanship within specified warranty period. Installer's special warranty in which manufacturer and Installer agrees to repair or replace components of decorative metal fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of gate operators and controls.
 - b. Faulty operation of magnetic lock.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Installation of fencing components including, but not limited to, footings, hardware assembly, fasteners and accessory installation, except when as a result of Owner occupancy, vandalism and occupancy related events.
 - e. Failure of rollers, guides, chain, equipment and other and active parts.
 - 2. Warranty Period:
 - a. Manufacturer's and Installer's Warranties:
 - 1) Five (5) years from date of Substantial Completion for labor necessary for repairs.
 - 2) Twenty (20) years from date of Substantial Completion for structural fence components.

PART 2 - PRODUCTS

2.1 DECORATIVE METALLIC-COATED STEEL TUBULAR PICKET FENCES

- A. Decorative Metallic-Coated Steel Tubular Picket Fences: Comply with ASTM F 2408, for industrial application (class) unless otherwise indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Montage II. Products by one of the following manufacturers may be submitted by substitution request to architect for consideration:
 - a. Beta Fence
 - b. Fortress Iron; a division of Woodmark International, LP.
 - c. Iron Eagle Industries, Inc.
 - d. Master Halco.
 - e. Merchants Metals; a division of MMI Products, Inc.
 - f. Xcel Fence.
 - 2. Height: 8 feet, UNO.
 - 3. Color: Black
- B. Posts: 3" Square min.
 - 1. Metal and Thickness: 12 ga.
 - 2. Welded Ornamental Fence - Post Spacing by Manufacturer
- C. Post Caps: Manufacturer's standard metal.
- D. Rails: 1.75" x 1.75" x .105"
 - 1. Rails shall be pre-punched to accept pickets.
- E. Pickets: 1-inch Square.
 - 1. Metal and Thickness: 14 ga.
 - 2. Picket style: Classic.
 - 3. Picket Spacing: 4.715" O.C.
- F. Panel Hangers, Brackets and Fasteners: Shall be stainless or galvanized steel with stainless, galvanized or zinc plated fasteners. All brackets shall be finished to match fence finish and color.
- G. Galvanizing: For components indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

2.2 STEEL AND IRON

- A. Plates, Shapes, and Bars: Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (344 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/ft² (276 g/m²), Coating Designation G-90.
- B. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50 (Grade 340), with G90 (Z275) coating.

2.3 COATING MATERIALS

- A. Epoxy Zinc-Rich Primer for Steel: The manufactured panels and posts shall be subjected to an inline electro-deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

Table 2 – Coating Performance Requirements

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 2500 psi, 3-inch slump, and 1-inch maximum aggregate size.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

- D. Security Fabric: 1/2" #13 expanded wire mesh security fabric at pedestrian gates as shown on plans. Fabric shall be powder coated to match fence and gates. Fully weld to gate frame on secure side and extend 3'-0" along fence beyond latch side. Fabric to be matching black finish.

2.5 PEDESTRIAN SWING GATES

- A. Swing gates shall be fabricated using 1.75" x 14ga Forerunner double channel rail, 2" sq. x 12ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gates leaves over 6'.
- B. Gate Configuration: As indicated in plans.
- C. Gate Frame Height: 8'
- D. Gate Opening Width: As indicated in plans.
- E. Finishes: All finishes to be black.
- F. Door Contact Sensors: Owner Provided.
- G. Card Readers:
 - 1. Owner provided.
 - 2. Locations per plans.
 - 3. GC to coordinate installation with Owner's controls vendor.
- H. Knox Box:
 - 1. Provide Knox box for gate per fire marshal's requirements.
- I. Hinges: Self-closing, integrated hinge-closer set (3 qty) shall be ADA compliant that shall include a variable speed and final snap adjustment with compact design (no greater than 5" x 6" footprint). Hinge-closer set (3 qty) shall be tested to a minimum of 500,000 cycles and capable of self-closing gates up to a maximum gate weight of 260 lbs. and maximum weight load capacity of 1,500 lbs. Hinge-closer device shall be externally mounted with tamper-resistant security fasteners, with full range of adjustability, horizontal (.5" - 1.375") and vertical (0 - .5"). Maintenance free hinge-closer set shall be tested to operate in temperatures of negative 20 F to 200 F degrees, and swings to negative 2 degrees to ensure reliable final lock engagement.
- J. Latch:
 - 1. Per Door Hardware 08 7100.
- K. Electronic Strike:
 - 1. Per Door Hardware 08 7100.
- L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

2.6 HORIZONTAL-SLIDE VEHICLE GATES

- A. General: Comply with ASTM F 1184 for gateposts and single sliding gate types and size as recommended by engineer based on gate size, local wind loading requirements and installation type. Provide automated vehicular gates that comply with ASTM F 2200.
 - 1. Classification: Class 2 with internal roller assemblies.
 - 2. Gate Height: 8'
- B. Manufacturer and Delegated Design: Provide automatic horizontal-slide vehicle gate, posts, rollers, and components as a complete manufactured or fabricated system in accordance with the Drawings.
 - 1. Delegated Design: Drawings indicate design intent sizes and profiles. Manufacturer or fabricator shall engage a qualified engineer to design and confirm Architect's detailing.
 - 2. Coordinate gate size, type, weight, construction, and operation frequency with operator and controls and provide equipment rated for gate design and service class.
- C. Steel Tubing:
 - 1. Gate Material: Provide either steel gate components.
 - 2. Finish: Finish is to match decorative steel fencing.
 - 3. Gate Posts: Comply with ASTM F 1184. Provide rectangular tubular steel posts.
 - 4. Gate Frames and Bracing: Rectangular tubular steel.
 - 5. Frame Corner Construction: Fully welded.
- D. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
- E. Roller assemblies, gate wheels, guides, rails, brackets, catches and accessories: Provide as indicated and necessary for a complete, secure and functional installation. Provide wheel assemblies as necessary to support gate.
 - 1. Make provision with guards, shields, etc. for wheel assembly obstruction removal from track. Obstructions include ice, snow, branches, leaves etc.
- F. Concrete Grade Beam and Track: Provide manufacturer's standard track embedded or attached to a level concrete grade beam , with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- G. Knox Box:
 - 1. Provide Know box for gate per fire marshal's requirements.

2.7 GATE OPERATORS

- A. General: Provide factory-assembled automatic gate operation system designed for gate size, type, weight, construction, use, traffic-flow patterns, and operation frequency. Provide operation system for gate specified, of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended and provided by gate manufacturer complete with electric motor and factory-prewired motor controls, remote-control stations, control devices, power disconnect switch, obstruction detection device, lockable weatherproof enclosures protecting controls and all operating parts, and accessories required for proper operation. Provide enclosures with corrosion-resistant-protective and decorative finish and two

keys per lock. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics 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 approval.
 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. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics 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 approval.
 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.
- C. Comply with NFPA 70.
- D. UL Standard: Fabricate and label gate operators to comply with UL 325 Class III.
- E. 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: See electrical plans and specifications.
 2. Horsepower: Manufacturer's standard for the application but not less than 1 HP.
 3. Enclosure: Tamper resistant.
 4. Duty: Heavy duty.
 5. Service Factor: 1.15 for open drip proof motors; 1.0 for totally enclosed motors.
- F. Gate Operators: Provide the following types of Equipment base/pad or In ground mounted Operators:
1. Mechanical Telescoping Gate Operator:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum 60 feet per minute.
 - c. Maximum Gate Weight: Verify actual gate weight, but with a capacity of not less than 1,200 lb.
 - d. Frequency of Use: 25 cycles per hour.
 - e. Tamper resistant.
- G. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with enclosure for mounting and with space for additional optional equipment. Provide the following remote-control device(s):
1. Control Station: Provide control stations located remotely from gate in new Administration Building Server Room.

- a. Interior wall-mounted, momentary-contact, three-button-operated control station at building interior. Provide open, stop, and close functions. **Main control station shall have capability of holding rolling gate in open position during business hours**; this function is to override remote controls. Locate in the Server Room.
2. Card Readers:
 - a. Long range card reader to be Owner provided and installed by Owner's vendor.
 - b. Contractor to provide and installed pedestal for long range card reader. Locations per plans.
 - c. GC to coordinate installation with Owner's security vendor.
3. Clickers for Vehicles
 - a. Contractor to provide (10) remote controls for placement in vehicles.
4. Emergency Vehicle Reader:
 - a. System to be specified by fire marshal and provided by contractor.
 - b. Locations per fire marshal's requirements and attached to gate/fence posts.
 - c. Contractor to install system.
- H. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, timer cut-off switch, and loop detector designed to open and close gate, and hold gate open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - a. Loop: Wire, in size indicated for field assembly, for saw-cut with epoxy-grouted installation.
- I. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing, timer cut-off switch, and presence detector designed to hold gate open until traffic clears and reverse gate.
- J. Infrared Sensor- Designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator. Provide EMX Industries, Inc model IRB-4X or approved substitution.
 - a. Non-reflective through beam not affected by shiny surfaces.
 - b. Not affected by sunlight, rain, dust or dirt.
 - c. Wide temperature operating range.
 - d. Water tight housing
 - e. Protective hood
- K. 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: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.

2. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using manufacturer's standard system.
 - a. Along entire gate leaf leading edge.
 - b. Along entire gate leaf trailing edge.
 - c. Along entire length of gate guide posts.
- L. 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 key.
- M. Operating Features:
 1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
 2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
 3. Automatic Closing Timer: With adjustable time delay before closing and timer cut-off switch.
 4. Open Override Circuit: Designed to override closing commands. Telescoping rolling gate and swing gate must be able to remain open, as controlled from the main control station at the front counter, during normal business hours.
 5. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
 6. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
 7. Clock Timer: 24-hour, Seven-day programmable for regular events.
- N. Accessories:
 1. Warning Module: Audio, Visual, strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines. Alarm must be able to be disabled through programming.
 - a. Provide override on warning module when gates are set to open position during normal business hours. Audible and visual strobe light alarm should not run continuously when gates are set to open position.
 - b. Provide general override option for light and audible alarms.
 2. External electric-powered lock with delay timer allowing time for lock to release before gate operates.
 3. Fire Department key box.
 4. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
 5. Equipment Bases/Pads: Cast-in-place or precast concrete, depth not less than 18 inches below grade, dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.

2.8 GROUNDING MATERIALS

- A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
 - 1. Construction layout and field engineering are specified in Division 01 Section "Execution"

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.
- C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
 - 1. Post Spacing: Provide per Table 3 above.
- D. 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 and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

3.4 GATE AND OPERATOR INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. 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. Installation must comply with the requirements of all applicable codes and AHJ.
- B. Install operators per manufacturer's instructions. Ensure that electric service meets manufacturer's requirements for amperage and that wire size conforms to specific operator requirements. Test the basic operator functions through 10 full cycles and adjust as needed to ensure gate operators smoothly without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.
- C. Excavation for Support Posts, Pedestals and 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.
- D. Vehicle Loop Detector System: cut grooves in pavement, bury, and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.
- F. Magnetic Lock Devices: Provide power source for magnetic lock that is separate from operator.

3.5 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, alarms, 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, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lubricate hardware, gate operator, and other moving parts.

3.6 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 32 3119

SECTION 33 01 03 – SITE EXISTING UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 LEGAL REQUIREMENTS UNDERGROUND FACILITIES

- A. The Contractor shall, before commencing excavation in any area, comply with the provisions of revised RCW 19.122 (E25HB 1634) and any other applicable laws relating to or governing the identification, location, marking, and responsibility for protecting and repairing of underground facilities.
- B. Whenever there may be a conflict between the provisions of any law and the provisions of these specifications, the provisions of law shall control.

1.3 DEFINITIONS

- A. Utility means any facility or item placed above or below ground for use in connection with the storage or conveyance of water, sewage, electronic, telephonic or telegraphic communication, cablevision, electric energy, petroleum products, gas, gaseous vapors, hazardous liquids, or other substances and including, but not limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, and attachments.
- B. Pipe zone is defined as extending from the bottom of the required excavation to six (6) inches over the top of the pipe.

1.4 IDENTIFICATION

- A. All underground utilities known by the Owner to be in the proposed area of excavation are identified on the project plan.
- B. The underground utilities identified on the plans have not and cannot be precisely located by the Owner or its agents or engineers and location is approximate only because such information is within the control of the owners of the underground utilities. The Owner, under this Contract, does not warrant the location of underground utilities.
- C. NOTICE: Overhead electrical service lines are generally not shown on the drawings. Electrical transmission lines shown on the drawings are located by point to point, power pole to power pole connections. The transmission cables or wires may be located on either side of the drawing location depending upon the configuration of the crossarms on the power poles or towers. Line voltage is not shown.
- D. Other overhead utility lines are generally not shown on the drawings.

1.5 NOTIFICATION

- A. It is the responsibility of the Contractor to give notice to the Owner or owners of any utilities known or suspected to be within the area of any proposed excavation or construction activities.
- B. The Contractor is responsible to have the locations of underground utilities marked by the utility owners prior to beginning excavation.
- C. The Contractor is responsible for determining the extent of any hazard created by electrical power in all areas and shall follow procedures during construction as required by law and regulation. Prior to construction, the Contractor shall meet with utility owners and determine the extent of hazards and remedial measures and shall take whatever precautions may be required.
- D. The Contractor's attention is directed to federal, state, and local safety codes relative to limitations of work in proximity to overhead power lines.

1.6 QUALITY ASSURANCE

- A. The Contractor will be required to have available a pipe finder and a person capable in its use and to utilize same to satisfy himself as to the exact location of such underground facilities in the interest of avoiding unnecessary damage, maintenance costs, and to insure continuity of customer service.
- B. Contractors shall cooperate with utility owners to aid in locations and maintenance of existing utilities.

1.7 ELECTRICAL TRANSMISSION AND SERVICE LINES

- A. Since neither the Engineer nor the Owner can anticipate the construction methods or techniques and equipment to be used by the Contractor in performing the work, the extent of the possibility of the Contractor's equipment and personnel coming in contact with electrical transmission lines cannot be fully anticipated, and there is no representation that all electrical transmission lines are shown on the plans.
- B. The Contractor is charged with the responsibility of observing and investigating the presence of any electrical transmission lines which might impinge on his work whether overhead or underground and shall consult with and utilize the information given by utility owners and operators to determine the extent of any hazards and remedial measures required, and follow appropriate safety procedures.

1.8 ABOVE GROUND UTILITIES

- A. Existing above ground utilities, whether shown on the drawings or not, shall be maintained, relocated, rerouted, removed and restored as may be necessary by the Contractor in a manner satisfactory to owners and operators of the utilities.

1.9 UTILITY SERVICE LATERALS

- A. Underground utility service lines, including but not limited to sanitary sewer services, gas services, water services, house or yard drains, and electricity or telephone services and driveway culverts shall be maintained, relocated, rerouted, removed and restored by the Contractor with the least possible interference with such services.

- B. Even though the presence of underground utility service lines may be deemed changed or differing conditions, in no case shall the interference of such service lines be the basis for extra compensation except in the case of a conflict, not shown on the plans, with sanitary sewer service occurring at an elevation between the top and bottom of the proposed pipeline or structure together with the pipe zone..

1.10 RESTORATION BY UTILITY OWNER

- A. The right is reserved by owners of public utilities and franchises to enter upon any street, road, right-of-way, or easement for the purpose of maintaining their property and for making necessary repairs or adjustments caused by the Contractor's operations.
- B. The Contractor shall save the Owner harmless of any costs so incurred in restoration of a utility damaged by the Contractor except in special cases outlined above, and subject to the provisions of any law.

1.11 RESTORATION OF DRAINAGE FACILITIES

- A. Where it is necessary for drainage facilities to be removed and replaced, existing pipe and catch basins may be reinstalled when approved by the agency having jurisdiction.
- B. The materials shall be cleaned.
- C. When it is necessary to replace existing pipe or catch basins, the new materials shall be of equal strength and similar design to existing materials.
- D. Installation shall be in accordance with the applicable provisions of these specifications.
- E. All costs, whether new or existing facilities are installed, shall be considered to be included in the unit prices bid for the various items and no additional payment shall be allowed.

END OF SECTION 33 01 03

SECTION 33 01 30.13 – SEWER AND MANHOLE TESTING

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 contains testing requirements of force mains, gravity sewer lines, and manholes. Contractor shall furnish all labor materials and testing equipment necessary to carry out the testing specified herein.
- B. Required and allowable testing methods are dependent upon materials of construction, whether the item to be tested is in service or newly constructed, and whether the item to be tested is to convey flow by gravity or force main. Matrices are attached to this section to aid the Contractor in selection of approvable technologies.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. Division 33 Sections for respective force main, manhole, and sewer pipe installation requirements.
 - 2. Division 33 Section “TV Inspection of Sewer Pipelines” for requirements related to televising sewer lines.

1.4 REFERENCES

- A. ASTM – American Society of Testing and Materials.
 - 1. C828 - Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
 - 2. C924 - Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - 3. C969- Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
 - 4. C1091 - Standard Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines.
 - 5. C1214 - Standard Test Method for Concrete Pipe Sewer lines by Negative Air Pressure (Vacuum) Test Method.
 - 6. C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
 - 7. F1417 - Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.

8. F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.

1.5 SUBMITTALS

- A. For closeout: Test Reports performed with information such as:

1. Project title
2. Name of Contractor or Testing Agency performing test.
3. Time of day
4. Weather
5. Project location (Street)
6. Identifier (Manhole to manhole pipe section or manhole as applicable).
7. Pipe segment length
8. Pipe material
9. Line size
10. Approximate compass direction of viewing
11. Approximate pipe depth (give range if large discrepancy in pipe segment)
12. Approximate groundwater depth above pipe or up manhole as applicable)
13. Test results (CCTV video/pictures, thickness data, etc.)

PART 2 - PRODUCTS

2.1 DEFLECTION MANDREL

- A. Mandrel Sizing. Rigid mandrel shall have OD equal to 95 percent of inside ID of pipe. ID of pipe, for purpose of determining OD of mandrel, shall be average OD minus two minimum wall thicknesses for OD controlled pipe and average ID for ID controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of ID of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.
- C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.
- D. Mandrel Dimensions (5 percent allowance). Average ID and minimum mandrel diameter are specified in Table 4, Pipe vs. Mandrel Diameter, at end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by AW Project Manager.

2.2 HYDROSTATIC TEST

- A. Valves and Pipe Plugs as needed to isolate the test section.

2.3 EXFILTRATION TEST

- A. Test Equipment:
 - 1. Pipe plugs.
 - 2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

2.4 INFILTRATION TEST

- A. Test Equipment:
 - 1. Calibrated 90 degree V-notch weir.
 - 2. Pipe plugs.

2.5 LOW PRESSURE AIR TEST

- A. Minimum Requirement for Equipment:
 - 1. Control panel
 - 2. Low-pressure air supply connected to control panel.
 - 3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
 - 4. Air hoses from control panel to:
 - a. Air supply.
 - b. Pneumatic plugs.
 - c. Sealed line for pressuring.
 - d. Sealed line for monitoring internal pressure.
- B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.6 GROUND WATER DETERMINATION

- A. Equipment: Pipe probe or small diameter casing for ground water elevation determination, or approximate depth from observations during excavation/trenching.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

- B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Control of Ground Water and Surface Water.
- C. Prior to testing, all mains shall be flushed clean of debris. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.
- D. No testing shall be done until all sewer line sections between manholes are completed and in-place, with straight alignment and uniform grade.
- E. Testing shall be done in a manner that also minimizes traffic impacts or other potential hazards and may require the Contractor to test relatively short sections of completed lines.

3.2 MANDREL TESTING FOR GRAVITY SANITARY AND STORM SEWERS

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- B. Testing shall be conducted on a cleanout to cleanout basis and shall be done after the line has been completely flushed out with water.
- C. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- D. Contractor will be required, at his expense, to locate and repair any sections failing to pass the test.
- E. Retest repaired, replaced, re-excavated, or re-compacted sewer sections .

3.3 HYDROSTATIC TESTING OF FORCE MAINS

- A. Filled pipelines shall be allowed to thermally stabilize such that the temperature of the water and the pipe are equal. At temperatures above one hundred (100) degrees F, the Engineer shall be consulted regarding the need to reduce the test pressure.
- B. The piping shall be tested between valved sections or to a maximum length of one thousand, five hundred (1,500) feet.
- C. For any test pressure from 1.0 to 1.5 times the system design pressure, the total test time including initial pressurization, initial expansion, and time at test pressure, shall not exceed eight hours. If the pressure test is not completed due to leakage, equipment failure or other reason, the test section shall be depressurized, and allowed to “relax” for at least eight hours before bringing the test section up to test pressure again.
- D. Expansion Phase
 - 1. Initial expansion phase: Fill pipe at a controlled flow rate according to the Equation $Q_{\text{gpm}} = 0.402 * D_{\text{inches}}^2$ which is summarized with Table A below for reference. Use of a

urethane foam pig, pushed by the fill water, is permissible to aid in air removal in the initial phase.

TABLE A

Pipe Diameter (in)	Initial Phase Fill Rate (gpm)
1	0.4
2	1.5
4	6
6	14
8	25
10	40

2. Fill pipe to pressurize test section to 10 psi above the test pressure (see Table B for Expansion Pressure). Add sufficient make-up water each hour to return the pipe pressure to the expansion phase pressure. Pressure should be measured at the lowest elevation in the piping run being tested.
 3. The initial expansion phase shall be completed after four hours after pressurization.
- E. Test Phase: Reduce pressure by 10 psi and conduct the test for one hour. Make-up water is not allowed during the test phase. Table B below may be used for reference.
1. The test passes after the pressure remains steady within five percent of test phase pressure after one hour.
 2. If the pressure falls below five percent of the test pressure (see Table B), leakage or insufficient expansion is indicated, and the test shall be repeated after the pipe is allowed to “relax” as indicated above and repairs are completed.

TABLE B

Pipe Class (SDR)	Expansion Pressure (psi)	Test Pressure (psi)	5% Reduction Pressure (psi)
17	150	140	133
13.5	170	160	152
11	170	160	152
9	210	200	190

- F. Release water from the test run in a controlled manner to slowly reduce pressure.
- B. Test pipe in presence of Engineer.

3.4 LEAKAGE TESTING FOR GRAVITY SANITARY AND STORM SEWERS

- A. Test Options:
1. Test gravity sanitary sewer pipes for leakage by either exfiltration, infiltration, or with low pressure air testing.

2. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
- B. Compensating for Ground Water Pressure:
1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10-inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
 2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 ft/psi to determine ground water pressure to be used in line testing.
- C. Exfiltration test:
1. Determine ground water elevation.
 2. Plug sewer in downstream manhole.
 3. Plug incoming pipes in upstream manhole.
 4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
 5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
 6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 1.
- D. Infiltration test: Ground water elevation must be not less than 2 feet above highest point of sewer pipe or service lead (house service).
1. Determine ground water elevation.
 2. Plug incoming pipes in upstream manhole.
 3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
 4. Allow water to rise and flow over weir until it stabilizes.
 5. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 1.
- E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F1417, as applicable based on pipe material, with holding time not less than that listed in Table 2 in the attached Schedule.
1. Air testing for sections of pipe shall be limited to lines less than 27-inch average inside diameter. Larger pipe diameters can be low pressure air tested if the testing protocol is designed by a local P.E and if approved by AW Project Manager.
 2. Lines 27-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
 3. For pipe sections less than 27-inch average inside diameter:
 - a. Determine ground water level.
 - b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.

- c. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
- d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 2.
- e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 2 for pipe diameter and length. For sliplining, use diameter of carrier pipe.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.5 REPAIR

A. The Contractor shall repair all leaks in the piping at no cost to the Owner.

END OF SECTION 33 01 30.13

SECTION 33 05 26 – UTILITY IDENTIFICATION

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. Contractor shall furnish and install warning tape and tracer wire on all underground utility piping shown on the Contract Plans and details.

1.3 RELATED SECTIONS

- A. Division 26 Sections for electrical method requirements.
- B. Division 33 Sections for open trench pipe installation method requirements.

1.4 REFERENCES

- A. American Public Works Association (APWA):
 - 1. Uniform Color Code

PART 2 - PRODUCTS

2.1 WARNING TAPE

- A. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 4 mils thick, continuously inscribed with a description of the utility imprinted continuously along its length along with the word "Caution"; and a metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep when used over non-metallic duct or pipe. Tape width as recommended by manufacturer based on depth of installation. Tape shall be colored to APWA standards as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, LPG, oil, steam, and other dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Storm and Sanitary Sewer systems.
 - 6. Purple: Non-Potable and Reclaimed Water.

2.2 TRACER WIRE (OPEN TRENCH INSTALLATION METHOD)

- A. Tracer wire components shall be provided by Copperhead Industries or equal.
- B. Tracer wire shall be constructed with a #10 AWG copper conductor and with a 30 MIL HDPE insulated jacket. Jacket color shall be suitable for the utility being traced per the American Public Work Association Uniform Color Code.
- C. Tracer Wire shall be extra high strength with a minimum break load of 650 lb.
- D. Copper Conductors: Copper conductors shall be annealed copper (soft drawn). Conductors shall meet or exceed all applicable ASTM specifications, and requirements of the National Electrical Code, including: ASTM B-3, Standard Specification for Soft or Annealed Copper Wire; and ASTM B-170, Standard Specification for Soft or Annealed Copper Wire.
- E. HDPE Jacket: Conductors shall be insulated with high density, high molecular weight, polyethylene (HDPE) insulation. Jacket shall meet or exceed all applicable ASTM specifications, and requirements of the National Electrical Code, including: ASTM D1248, Standard Specification of Polyethylene Plastics Extrusion Materials for Wire and Cable; and ASTM D1238 Standard Test Methods for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

2.3 UNDERGROUND TERMINALS

- A. Underground terminals, or “fink boxes”, shall be flush mount type, installed with a concrete collar.
- B. Terminals shall be provided by Copperhead Industries or equal.
- C. Housing, cover, and terminal board shall be made of high strength polycarbonate alloy plastic. The complete assembly shall be rated for H20 traffic loading and impervious to chemicals routinely used in street maintenance and snow removal.
- D. Terminal board shall have nickel plated brass terminals. Number of terminals shall be as required for specific installation with a least four spare terminals.
- E. Minimum dimensions shall be 5-1/2 inch diameter, 8 inches high, and base shall be sized to fit a 4 inch schedule 40 pipe.
- F. Terminals must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
- G. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes

2.4 GROUNDING

- A. Grounding components shall be provided by Copperhead Industries or equal.
- B. Trace wire must be properly grounded at all dead ends/stubs
- C. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode

(minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.

- D. When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
- E. When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- F. Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

2.5 CONNECTORS

- A. Connectors shall be provided by Copperhead Industries or equal.
- B. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
- C. **Direct bury wire connectors** – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- D. Non locking friction fit, twist on or taped connectors are prohibited.

PART 3 - EXECUTION

3.1 WARNING TAPE

- A. Install warning tape label side up at a depth of 12" above the top of pipe, on properly compacted backfill. Tape shall be placed as follows:
 - 1. Along the centerline of the utility piping.
 - 2. At corners of buried structures such as catch basins.
 - 3. For circular structures such as manholes, install tape above the largest diameter section, extending around the circumference.

3.2 TRACER WIRE

- A. Tracer wire shall be placed a minimum of eight inches above utility infrastructure. It shall be placed carefully, and great care shall be exercised when continuing backfilling.

- B. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- C. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
- D. Splices in tracer wire shall be kept to an absolute minimum. When splices are necessary they shall be made with weatherproof splice kits rated for direct bury use.
- E. Tracer wire shall be color coded to match the type of utility infrastructure traced. Colors shall be in conformance with the American Public Work Association Uniform Color Code, per ANSI Standard Z535.1 Colors utilized on the Urbana-Champaign Campus are: Red for electric; yellow for natural gas, compressed air and steam; green for storm and sanitary sewer; orange for communications; blue for potable water; purple for non potable water and chilled water.
- F. Terminal boxes shall be located as required by layout of infrastructure, but not greater than 1500 linear feet apart. Terminal boxes shall not be located in streets, or drives, or other areas subject to vehicular traffic. Terminal boxes shall be placed on either side of a bored or directionally drilled pipe.
- G. Terminal boxes shall have at least four spare terminals to allow for future use.
- H. Terminal boxes shall be installed flush with finished grade, and centered in a grade level concrete pad. The concrete pad shall be 18 inch by 18 inch, and 6 inches deep.
- I. Tracer wire shall be installed with the following utilities: natural or LP gas, non potable water, potable water, sewer force mains, or other installations as indicated on the Construction Documents.

3.3 TESTING

- A. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.
- B. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.
- C. Continuity testing in lieu of actual line tracing shall not be accepted.

END OF SECTION 33 05 26

SECTION 33 14 15 – SITE WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 22, 31, 32 and 33 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

- A. Testing Before Acceptance:
 - 1. The Engineer may require that the first section of pipe, not less than 1,000 feet in length, installed by each of the Contractor's crews, be tested in order to qualify the crew and/or the material.
 - 2. Pipe laying shall not be continued more than an additional 1,000 feet until the first section has been tested successfully.
- B. Final Acceptance:
 - 1. Prior to final inspection all pipelines shall be flushed and cleaned of all debris, disinfected and hydrostatically tested.
 - 2. Any corrections required shall be made at the expense of the Contractor and the line retested.

PART 2 - PRODUCTS

2.1 BEDDING MATERIALS

- A. Conform to Section 312000.

2.2 PIPE AND FITTING MATERIALS

- A. Ductile Iron Pipe
 - 1. Ductile iron pipe shall be new, thickness Class 52, cement-lined, conforming to ANSI Standard A21.51 (AWWA C-151). Standard thickness cement mortar lining shall be in accordance with ANSI Standard A21.4 (AWWA C-104).
 - 2. Ductile iron pipe shall be push-on joint or mechanical joint. Pipe with push-on joints shall be furnished with a single rubber ring gasket. All gaskets, including MJ shall be lubricated to affect the seal. This lubricant shall be a water soluble type lubricant, which has been approved for use in drinking water applications. Pipe with mechanical joints shall be furnished with a mechanical joint of the stuffing box type, including rubber gasket, cast-iron gland, and tee-head bolts and nuts to effect the seal. All joints shall conform to ANSI Standard A21.11 (AWWA C-111). Flanged joint shall conform to ANSI Standard A21.10 (AWWA C110).
 - 3. When required by the District or design engineer, joints shall be restrained joints. Internally-locked joints shall be in accordance with ANSI A21.11 and equal to U.S. Pipe Field Lok 350 or approved equal. EBAA Iron Mega-lugs or approved equal restraining follower glands may be used at mechanical joints.

4. The Contractor shall furnish certification from the manufacturer of the pipe and gasket being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of referenced standards.

B. Ductile Iron and Gray Iron Fittings

1. Use for ductile iron or PVC pipe.
2. Conform to AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI 1921.53) as indicated.
3. Joint shall conform to AWWA C111 (ANSI A21.11).
4. Dimensions of fittings and design of bell may be modified to conform with the pipe being used.
5. Cement mortar lining conforming to AWWA C104 (ANSI A21.4).
6. Gaskets for flat faced or raised faced flanges shall be 1/8 inch thick neoprene having a durometer of 60 plus or minus 5.
7. Gaskets for flanges having a recess machined to receive an "O" ring shall be neoprene and shall have the dimensions and durometer as recommended for the particular service application by the flange manufacturer.
8. Provide type, material and identification mark for bolts and nuts.

C. Flexible Couplings

1. Use for connection between plain end pipe of same or different material.
2. Sleeve: Gray iron ASTM A126 Class B or ductile iron ASTM A536. Ends have a smooth inside taper for uniform gasket seating.
3. Followers: Ductile iron ASTM A536.
4. Gaskets: Grade 30 specially compounded rubber of all new materials.
5. Bolts and nuts: High strength low alloy steel with heavy, semi-finished hexagon nuts to AWWA C111 (ANSI A21.11).

D. Water Service Pipe

1. Per applicable Skagit PUD Standard Detail.

E. Other Water Service and Water Meter Materials

1. Per applicable Skagit PUD Standard Detail

F. Double Check Detector Assembly

1. Per applicable Skagit PUD Standard Detail

G. Sump Pump

1. Fractional horsepower, integrated float switch; Little Giant or approved equal

H. Sump Pump Discharge Line

1. PVC, Schedule 40

I. Reduced Pressure Backflow Assembly

1. Per applicable Skagit PUD Standard Detail

J. Post Indicator Valve

1. Valve shall be UL/FM rated, size as noted on plans.

2.3 GATE VALVES - (UNDER 12 INCHES)

A. Conform to AWWA C509.

B. Iron body, bronze stem, resilient wedge.

- C. O-ring stuffing box.
- D. Open counter-clockwise unless otherwise specified.
- E. Non-rising stem type.
- F. Equipped with a 2 inch standard operating nut.
- G. Mechanical joint or push on joint suitable for installation with the type and class of pipe being used or flanged where detailed.
- H. All flange faces shall be machined. Flanges shall be drilled to straddle vertical centerline.

2.4 STEM EXTENSION

- A. Provide stem extension with standard operating nut and self centering rock plate support for all valves with operating nut more than 4 feet below grade to raise operating nut to within 36 inches of the ground surface.

2.5 VALVE BOXES

- A. Provide for all buried valves.
- B. Valve boxes and tops shall be cast iron 2 piece slip joint type.
- C. Lengths suitable for the particular project or as specified.
- D. Base corresponding to size of valve.
- E. Cover shall have the word "Water" cast on it.

2.6 VALVE MARKER POST

- A. Shall have a 4-inch minimum square section and a minimum length of 42 inches, with beveled edges.
- B. Contain at least one No. 3 bar reinforcing steel.
- C. Paint exposed portion of the marker posts with two (2) coats of concrete paint in a color selected by the Owner.
- D. Stencil the size of the valve and the distance in feet and inches to the valve on the face of the post, using black paint and a stencil which will produce letters 2 inches high.

2.7 FIRE HYDRANTS

- A. Conform to AWWA C502 except as herein modified.
- B. Main valve opening of the hydrant shall be a minimum of 5 inch diameter.

- C. Provide mechanical or flanged joint outlet with an auxiliary gate valve and valve box. Suitable lugs for anchor rods shall be provided.
- D. One pumper nozzle to match Owner's existing pattern, two (2) two and one-half inch (2-1/2") hose nozzles shall be provided.
- E. Provide pentagon operating nuts.
- F. Open by turning counterclockwise.
- G. Nozzles and operating nuts shall be identical with the Owner's existing equipment or as elsewhere provided.
- H. Nozzles shall be equipped with bronze nipples screwed into the hydrant and locked in place.
- I. Depth of clear cover over the pipe shall be three (3) feet unless larger depth or cover is required where the hydrant is installed.
- J. Provide lugs for shackling rods.
- K. Provide sidewalk flange and safety stem coupling which will allow hydrant barrel to separate with minimum damage.
- L. Paint with two coats of paint to match the Owner's existing hydrants.
- M. The Contractor shall furnish the location of the nearest point at which replacement working parts are stocked.
- N. Hydrant barrel extension standard of manufacturer of hydrant provided.
- O. Hydrants shall be as manufactured by Clow Model 2500 or equal.

2.8 GUARD POST

- A. Precast concrete 8 inches in diameter by six feet long constructed with concrete having minimum strength of 3500 psi.
- B. Reinforcing shall consist of minimum of five No. 3 deformed steel bars.

2.9 YARD HYDRANTS

- A. Per Drawing callouts or approved equal.
- B. Frost Proof Hose Bibbs:
 - 1. Type: Nonfreezing, exposed head, stop and waste post hydrant with non-turning operating rod with free-floating compression closure valve, drain port, and operating key lock.
 - 2. Size: 1 inch.
 - 3. Hose Connection: 1 inch American National straight.
 - 4. Rating: 150 psi.
 - 5. End: Screwed.
 - 6. Casing: Bronze.
 - 7. Casing Guard: Cast aluminum.

8. Exposed Head: Bronze.
9. Interior Parts: All bronze.
10. Curb Stop and Waste Valves:
11. Type: 90° turn plug, solid tee head, with check and drain port.
12. Size: Same as line size.
13. Rating: 150 psi.
14. Body and Trim: Bronze.
15. Ends: Screwed.
16. Operators: Two portable tee wrenches supplied to service all buried yard curb stop and waste valves.
17. Service Boxes: Cast iron, 2½-inch minimum shaft diameter, cast iron lids marked "Water".

PART 3 - EXECUTION

3.1 BEDDING FOR RIGID PIPE

- A. Bedding for rigid pipe except ductile iron shall be as specified in Section 312000.
- B. Unless otherwise ordered, bedding for ductile iron may be native bedding material, free of stones.
- C. Bedding shall be carefully placed under the pipe and to a depth of at least six (6) inches over the top of the pipe.
- D. Shall be thoroughly rammed and tamped around the pipe with the proper tools, so as to provide firm and uniform support over the full length of all pipe, valves and fittings.
- E. Care shall be taken to prevent any damage to the pipe or its protective coating.

3.2 BEDDING FOR FLEXIBLE PIPE

- A. Material to be used for bedding for flexible pipe shall be sand/gravel material as specified in Section 312000.
- B. Bedding shall be placed in more than one lift. The first lift is to provide at least 4-inch thickness under any portion of the pipe and shall be placed before the pipe is installed, and shall be spread smoothly so that the pipe is uniformly supported along the barrel.
- C. Subsequent lifts of not more than 6-inch thickness shall be installed to 6 inches over the crown of the pipe and individually compacted to 90 percent of maximum density.

3.3 PIPE LAYING

- A. Pipe laying shall be done in accordance with the Specifications and instructions of the manufacturer of the kind of pipe used.
- B. Tools designed especially for installing each particular type and kind of pipe shall be used.
- C. Short Lengths and Field Cut Joints:
 1. Short lengths of pipe supplied by the manufacturer shall be used to provide the proper spacing of valves, tees or special fittings.

2. Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter.
3. Pipe ends shall be square with the longitudinal axis of the pipe and shall be reamed and otherwise smoothed so that good connections can be made.
4. Threads shall be cleanly cut.
5. Flaring of copper tubing shall be accurately and smoothly done.
6. All operations for any connection shall be carefully done in accordance with the manufacturer's instructions.

D. Laying of Pipe on Curves:

1. Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints or by the use of shorter lengths of pipe.
2. When pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment.
3. Where field conditions require deflection or curves not anticipated by the Plans, the Contractor shall use deflected joints, short lengths or special fittings as required. No additional payment will be made for laying pipe on curves as shown on the Plans or for field changes involving pipe deflected at the joints. When special fittings not shown on the Plans are required to meet field conditions, additional payment will be made for fittings.
4. Maximum deflections at pipe joints and laying radius for various pipe lengths shall be as recommended by the pipe manufacturer.

E. Contamination Prevention:

1. Pipe, fittings and valves shall be carefully cleaned of all dirt and foreign material as they are placed.
2. Open ends of pipe and fittings shall be plugged with a temporary watertight plug whenever work is stopped and/or when water in the trench threatens to enter the pipe.
3. Groundwater shall be excluded from the pipe at all times.
4. Particular care shall be exercised to guard against the entrance of sewage into the water line trench during the course of construction. All sewer lines, house side sewers or other subsurface drains should be located prior to excavation. Adequate provision shall be made for the flow of sewers, drains, and other water courses during construction.

F. Condition of Pipe and Fittings:

1. The interior of all pipe, fittings and other accessories stockpiled on the project shall be kept free of dirt and other foreign matter at all times.
2. Each pipe, fitting or other accessory shall be carefully inspected and thoroughly cleaned of any dirt or foreign matter that might be present on the inside.
3. Cleaning shall be accomplished prior to lowering the pipe or other accessories into the trench.
4. Care shall be taken to keep materials internally clean after the pipe is placed in the trench.

3.4 BLOCKING AND BRACING

- A. Blocking and bracing of the pipe and fittings shall be placed so as to secure bearing on undisturbed earth.
- B. Blocking and bracing size shall be determined by the Contractor and shall be of sufficient proportions and installed so as to withstand the required test pressure and operating conditions.
- C. Concrete shall be placed in back of all fittings with unbalanced thrust. Pre-cast blocking shall not be used.
- D. Blocking shall not be covered up without its having been seen by the Engineer.

- E. Blocking shall be formed so that bolts, joints, gaskets, and flanges of adjacent joints are clear of the concrete and so that bolts and joints can be dismantled without removing the concrete.
- F. At tees and crosses where future mains connect, a pre-cast concrete brick may be used between fittings and thrust block.
- G. Unless otherwise called for in the Bid Form, the cost of furnishing and installing all blocking shall be included in the price bid per lineal foot of pipe or lump sum bid if unit prices are not required.

3.5 CONNECTION TO EXISTING WATER MAINS

- A. An approved backflow prevention assembly (double check valve assembly or better) must be used on the supplying water line when filling the new water main during disinfection and flushing. The assembly and supply piping must be removed or isolated during hydrostatic pressure testing of the new main.
- B. Type of connections shall be as shown on the Drawings.
- C. Connections to the existing water main shall not be made without first making the necessary arrangements with the Owner in advance.
- D. Work shall not be started until all of the materials; equipment and labor necessary to properly complete the work are assembled on the site.
- E. When work is once started on this connection, it shall proceed continuously without interruption and as rapidly as possible until completed. No shut-off of mains will be permitted overnight or over weekends or holidays.
- F. If the connection to the existing system involves turning off the water, the Contractor shall be responsible for notifying the residents affected by the shut-off. The Owner will advise which owners are to be notified.
- G. The Contractor may be required to perform the connection during times other than normal working hours.
- H. The Contractor shall not operate any valves on the existing system without specific permission of the Owner.
- I. The types of connections are varied and suggested pipe arrangements have been shown on the Plans. In general, they involve deflecting new pipe to match the existing pipe alignment and utilization of necessary fittings and new pipe. For the installation of these connections, the surfaced portion of the road shall not be penetrated unless the connecting point is directly under it. For connection by any other method, the Contractor shall furnish a detailed sketch for approval not less than one week prior to the expected construction.
- J. Interior of pipe and fittings used in making connections shall be swabbed or sprayed with a 1% solution of hypochlorite before they are installed.
- K. Exterior of main shall be cleaned and interior surface of tapping sleeve shall be dusted with calcium hypochlorite powder before tapping sleeve is installed.
- L. Any replacement pipe used for cutting into existing mains shall be same material and strength as existing pipe except that ductile iron may be substituted for other materials.

3.6 EXISTING SYSTEM MAINTENANCE

- A. The Contractor shall acquaint himself with all aspects of the existing system prior to starting construction on new mains. Pertinent information concerning existing system may be obtained from the Owner and from the Owner's records.
- B. Materials, fittings, pumps, equipment and qualified personnel must be available on the project at all times during construction, so that in the event of damage to or disruption of the existing water system service there will be immediate repair and restoration by the Contractor. Any unnecessary delay in repairs or service restoration due to Contractor's failure to adhere to these requirements shall be reason to immediately suspend any further new main installation until repairs are completed to the Owner's satisfaction.
- C. Existing water services shall be located by the Contractor prior to beginning work so that it may be properly protected and maintained in service during construction and during the changeover from the existing pipes to the pipe installed under this Contract.

3.7 SERVICE CONNECTIONS

- A. Service connections to water mains except ductile iron Class 52 or stronger shall be made using saddles of the size and type suitable for use with the pipe being installed.
- B. Ductile iron Class 52 or stronger may be direct tapped with a corporation stop.
- C. The depth of trenching for service connection piping shall be such as to provide cover over the top of the pipe as shown on the service detail.
- D. Particular care shall be exercised to assure that the main is not damaged by installation of the service line.
- E. Service lines shall be cut using a tool or tools specifically designed to leave a smooth, even, and square end on the piping material to be cut. Cut ends shall be reamed to the full inside diameter of the pipe.
- F. Where shown in the plans, existing water service connections shall be reconnected to the new water mains installed under this Contract using the materials specified. The location of water service connections shall be verified in the field by the Contractor.
- G. Pipe materials used to extend or replace existing water service lines shall be in accordance with utility's standard details for new service.
- H. Insulating couplings shall be used at any connection between galvanized steel or iron pipe and copper pipe.
- I. Contractor shall arrange his work to minimize interruptions of water service to existing water customers.
- J. Line shall be installed, tested and disinfected up to point of connection prior to interruption of service.
- K. Customer shall be notified prior to shutting off service. Time that water is shut off shall be held to a minimum.

3.8 HYDROSTATIC PRESSURE TEST

- A. Water mains and appurtenances (including water service connections on new water mains) shall be tested in sections of convenient length under a hydrostatic pressure equal to 150 psi in excess of that under which they will operate.
- B. The pumps, gauges, plugs, saddles, corporations, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished and operated by the Contractor.
- C. Pipeline shall be backfilled sufficiently to prevent movement of pipe under pressure.
- D. Thrust blocks shall be in place and time allowed for the concrete to cure before testing.
- E. Procedure:
 - 1. The mains shall be filled with water and all air removed prior to starting the test.
 - 2. The test shall be accomplished by pumping the main up to the required pressure; stop the pump for fifteen (15) minutes, and then pump the main up to the test pressure again.
 - 3. The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter with a sweep unit hand registering 1 gallon per revolution. The meter shall be approved by the Engineer.
 - 4. Acceptability of the test will be determined by two factors:
 - 5. The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{ND(P)^{0.5}}{7,400}$$
 in which
 L = Allowable leakage, gallons/hour
 N = No. of joints in the length of pipeline tested
 D = Nominal diameter of the pipe in inches
 P = Average test pressure during the leakage test, psig
 - 6. There shall not be an appreciable or abrupt loss in pressure during the fifteen (15) minute test period.
 - 7. Gauges used in the test shall be accompanied with satisfactory certifications of accuracy from a laboratory approved by the Engineer.
- F. All tests shall be made with the hydrant gate valves open and pressure against the hydrant valve. After the test has been completed, each gate valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the gate valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked.
- G. Sections to be tested shall normally be limited to 1,500 feet.
- H. Prior to calling out the Engineer to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure himself that the pipe is in a satisfactory condition.

3.9 DISINFECTION OF MAINS

- A. Before being placed in service, all new water mains and repaired portions of, or extensions to, existing mains shall be chlorinated and a satisfactory bacteriological report obtained.

- B. Temporary or permanent physical connections shall not be allowed between the existing distribution system and non-disinfected pipelines constructed under this Contact without a State Department of Health approved backflow preventer (double check valve assembly or better) temporarily installed in the connecting line.
- C. Main sterilization shall be accomplished by either of the following two methods at the Contractor's option. No other method of sterilization will be accepted by the Engineer, unless, prior to use, the Contractor obtains written approval from the Engineer.
- D. Method No. 1:
 - 1. A chlorine gas-water mixture, or dry chlorine gas may be applied by means of a chlorinator, or the gas may be fed directly from a chlorine cylinder equipped with the proper devices for regulating the flow, and the effective diffusion of gas within the pipe. Use of the chlorinator is preferred to direct feed from the cylinder.
 - 2. The preferable point of application for the chlorinating agent is at the beginning of the pipeline extension, or any valved section thereof, and through a corporation cock inserted in the horizontal axis of the pipe. The water injector for delivering the gas-water mixture into the pipe may be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. In a new system, application may be at the pumping station, elevated tank, stand pipe, or reservoir.
 - 3. Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly laid pipeline during application of the chlorine. The rate of chlorine gas-water mixture or dry gas feed shall be in such proportion that the rate of water entering the newly laid pipe will be at least 50 parts per million.
 - 4. Back pressure, causing a reversal of flow in the pipe being treated, shall be prevented.
 - 5. Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least twenty-five (25) parts per million.
 - 6. In the process of chlorinating newly laid water pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.
 - 7. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity, until the replacement water throughout its length, upon test, shows the absence of chlorine or in the event chlorine is normally used in the source of supply, until the tests shall show a residual not in excess of that carried by the system.
 - 8. Should the initial treatment prove ineffective; the chlorination procedures shall be repeated until tests show that the water sample from the newly laid pipe conforms to the requirements of this specification.
- E. Method No. 2:
 - 1. A mixture of either calcium or sodium hypochlorite of known chlorine content and water may be substituted as an alternative for liquid chlorine. (Typical commercial products of this type are HTH, Perchloron, Clor, Purex, etc.).
 - 2. Prepare a solution containing approximately 5% available chlorine by weight, in the case of HTH or Perchloron, at 70% available chlorine, use 6 pounds per 10 gallons of water. In the case of Clor, at 15% available chlorine, add 2 parts of water to 1 part of Clor. For other strength compounds, adjust dilutions accordingly.
 - 3. To prepare the chlorine compound-water mixture, first make a paste, and then thin to slurry, to ensure getting all active ingredients into solution. The prepared solution shall be injected by means of a hypo-chlorinator, or hand or engine operated pump. Retention time, parts per million and pumping into the newly laid pipe shall follow the conditions outlined under Method No. 1 for chlorine applications.
 - 4. Provisions for flushing and bacteriological testing under this alternative shall be the same as those described in Method No. 1 above.

- F. Before placing the lines in service, a satisfactory report or approval shall be received by the Owner on samples collected from representative points in the new system.
- G. Sterilized sample bottles and/or instructions shall be obtained by the Contractor from the laboratory where the samples will be tested unless the Owner directs otherwise. Bacteriological test samples will be taken by the Owner. Corporation stops shall be inserted in the main by the Contractor at all locations required to take bacteriological test samples. If original test samples prove unsatisfactory, a charge of \$25.00 will be made for processing each additional sample.
- H. Discharge of hypo-chlorinated water to surface waters is strictly prohibited. The environment to which the chlorinated water is to be discharged shall be inspected by the Owner and, if there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to be wasted to neutralize the chlorine residual remaining in the water. Disposal may be made to any available sanitary sewer provided the rate of disposal does not overload the sewer and the disposal is approved by the sewer agency having jurisdiction. The sewer agency shall be given 48 hours advance notice of such disposal. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

3.10 FLUSHING THE MAINS

- A. Upon completion of pipe laying, chlorination and pressure testing, all dirt and foreign matter shall be removed by a thorough flushing through all hydrants, blow-offs or other approved means. Each section of newly laid pipe between valves or dead ends shall be flushed independently, and fire hydrants or other dead end appurtenances shall be flushed simultaneously with the parent line. A minimum flushing velocity of 2.5 fps shall be developed in the main.
- B. The Contractor shall be responsible for scheduling and organizing his work so as to use flushing water only during off-peak hours and in the most economical manner.
- C. Taps required by the Contractor for temporary or permanent release of air, chlorination or flushing purposes shall be provided by the Contractor as a part of the construction of water mains.
- D. No flushing shall be performed without the prior approval of the Owner.

3.11 CHLORINATING CONNECTIONS TO EXISTING WATER MAINS AND WATER SERVICE CONNECTIONS

- A. The chlorinating procedure to be followed shall be as specified in AWWA Standard C651. All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5-6% Cl).

3.12 PLACING IN OPERATION

- A. Upon completion of the work and before its final acceptance, the entire system shall be put in operation under normal pressure and operated at that pressure for a period of not less than ten (10) days by the Contractor.
- B. Any leaks or defects in the construction of the system that may develop shall be repaired and the test continued until the system is practically watertight.
- C. No provision of this Section shall be construed as waiving any provision of the Contractor's guarantee.

3.13 GATE VALVE OR BUTTERFLY VALVE INSTALLATION

- A. Valves shall be accurately set at places designated on the drawings.
- B. Inspect each valve for defects.
- C. Adjust stuffing boxes to ensure water tightness without binding the stem.
- D. Set valve and valve box plumb.
- E. Set lower casting of valve box so that it is supported by a Styrofoam collar not less than 2 inches in thickness.
- F. Tamp backfill around valve box to a minimum distance of 3 feet on all sides or to face of trench.
- G. Set valve box cover flush with surface.

3.14 VALVE MARKER POST

- A. Where required, set valve marker post at edge of right-of-way opposite the valve.
- B. Leave 18 inches of post exposed above grade.

3.15 BLOCKING

- A. Provide blocking for valve not connected to fitting with bolted connection.

3.16 TESTING

- A. Test valves along with pipeline in which they are installed.

3.17 SETTING HYDRANTS

- A. Hydrants shall be inspected in the field upon arrival to ensure proper working order.
- B. Hydrants shall be installed in accordance with the standard detail.
- C. Hydrants shall not be installed within 3 feet of a travelled roadway.
- D. A minimum 3-foot radius unobstructed working area shall be provided around all hydrants.
- E. Sidewalk flange shall be set 2 inches above finished grade.
- F. Hydrants shall be set on concrete blocks.
- G. Hydrant drain shall waste into a pit of 1-1/4-inch minimum washed rock situated at the base of the hydrant as shown in the detail.

- H. Hydrant laterals less than 50 feet long shall consist of a section of 6-inch ductile iron pipe from the main to the hydrant and shall include an auxiliary gate valve set vertically and placed in the line as indicated in the detail.
- I. Hydrant branches over 50 feet long shall consist of a section of 8-inch ductile iron pipe and include required reducer to connect to hydrant.
- J. Hydrants shall be restrained as shown in the detail. Shackle rods shall be cleaned and painted after installation with 2 coats of asphalt varnish, or with such other bituminous paint as may be approved by the Engineer.
- K. The exposed portion of the hydrant shall be painted with one field coat. The type and color of the paint will be designated by the Owner.
- L. Any new or existing hydrant not in service shall be identified by covering with a burlap or plastic bag.
- M. Install guard posts only where specifically directed by the Owner.

3.18 RESETTING OR RELOCATING EXISTING HYDRANTS

- A. Conform to applicable requirements for setting new hydrants.
- B. Material requirements to be adjusted to field conditions.

3.19 HYDRANT BARREL EXTENSIONS

- A. Provide where required due to placement of main at greater than normal depth or for adjustment to surface grade.

3.20 TESTING

- A. Test hydrants along with pipeline on which they are installed.

END OF SECTION 33 14 15

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Nonpressure transition couplings.
 - 3. Catch basins.
 - 4. Cleanouts
 - 5. Stormwater inlets.
 - 6. Pipe outlets.

1.3 DEFINITIONS

- A. CPP: Corrugated Poly Pipe

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product to be utilized.
- B. Shop Drawings:
 - 1. Catch basins, cleanouts, and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.

- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle catch basins according to manufacturer's written rigging instructions.

1.7 QUALITY ASSURANCE

- A. Testing before Acceptance: The Engineer may require that the first section of pipe, not less than 300 feet in length, installed by each of the Contractor's crews be tested in order to qualify the crew and/or the material. Pipe laying shall not be continued more than an additional 300 feet until the first section shall have been tested successfully.
- B. Final Acceptance: Prior to final inspection all pipelines shall be flushed and cleaned and all debris removed. Before storm sewer lines are accepted, all lines shall be tested for leakage as specified herein and inspected for line and grade by checking each section between manholes for alignment. A full circle of light shall be seen by looking through the pipe at a light held in the manhole at the opposite end of the section of storm sewer line being inspected. Any corrections required in line and grade shall be made at the expense of the Contractor.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPE MATERIAL

- A. Pipe used for storm drainage construction may be of corrugated polyethylene, reinforced concrete, polyvinyl chloride, ductile iron, galvanized corrugated steel pipe or corrugated aluminum alloy as identified on the plans.
- B. All pipe shall have flexible watertight joints utilizing rubber gaskets.
- C. All pipe shall meet the minimum strength requirements as specified for concrete pipe unless otherwise provided. Any rigid pipe material substituted for the class specified shall have a minimum three edge strength equal to or greater than that of the concrete pipe class indicated. Flexible pipe of the class specified herein or on the drawings shall be considered equivalent in load supporting capacity to rigid pipe as indicated, unless otherwise specified.
- D. When ductile iron pipe is specified, no substitute is permitted.
- E. Design is based on smooth wall pipe with a Manning friction factor of $n = 0.013$. Contractor may substitute larger size corrugated pipe upon approval of the Engineer. Review will be based on using a friction factor of $n = 0.024$.

2.2 PVC PIPE AND FITTINGS

- A. PVC Gravity Storm Sewer Piping:
 - 1. Pipe and Fittings: PVC gravity storm sewer pipe with bell-and-spigot ends and with integral ASTM F 477, SDR 35 with elastomeric seals for gasketed joints.

2.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.4 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:
 - 1. Description: Precast catch basins shall conform to WSDOT Standard Specification Section 9-05.50(3) and shall be of Type as indicated on the Plans.
 - 2. Adjusting Rings: Provide as indicated on the Plans.
- B. Frames and Grates:
 - 1. Provide as indicated on the Drawings.
 - 2. Conform to Standard Drawing.
 - 3. Casting for metal frame shall be cast steel, cast iron or ductile iron.
 - 4. Casting for grates shall be cast steel or ductile iron.
 - 5. Steel castings shall conform to the requirements of ASTM A27, Mild to Medium Strength Carbon Steel Castings for General Application, Grade 70 36.
 - 6. Cast iron castings shall conform to the requirements of ASTM A48, Class 30.
 - 7. Ductile iron castings shall conform to the requirements of ASTM A536, Grade 80 55 06.
 - 8. Repair of defects by welding not permitted.
 - 9. Dimensions to have +1/16 inch tolerance.
 - 10. Machine or grind supporting pads for solid non-rocking bearing in any of four possible positions in frame.
 - 11. Foundry name shall be embossed on top of grate. Lettering is to be recessed 1/16 inch.
 - 12. Material used for grate shall be designated by embossing "DI" (Duct Iron) or "CS" (Cast Steel) near Manufacturer's name.

2.5 STORMWATER INLETS

- A. Curb Inlets: Provide as indicated on the Drawings.
- B. Frames and Grates: Provide as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 SURVEY LINE AND GRADE

- A. The Contractor shall constantly check line and grade of the pipe and in the event they do not meet specified limits, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

3.3 BEDDING

- A. Proper preparation of foundation, placement of foundation material where required, and placement of gravel bedding shall precede the installation of all storm sewer pipe. This shall include the necessary preparation of the native trench bottom and/or the top of the foundation material as well as placement and compaction of required gravel bedding to a uniform grade. Gravel bedding around the pipe will be placed in a manner to meet requirements specified herein.
- B. Class F bedding shall be provided for all flexible pipe.
- C. The gravel bedding shall be placed so that the entire length of the pipe will have full bearing on the bedding. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug to assure uniform support along the pipe barrel.
- D. It may be necessary to change bedding classifications and the limits thereof during the progress of the construction, consistent with the requirements outlined under the definitions and requirements of the various classifications contained herein.
- E. Where unauthorized excavation has been made below the established grade, the Contractor shall provide, place and compact suitable bedding material to the proper grade elevation at his own expense.
- F. Classification of Bedding:
 - 1. Class F bedding shall be placed in more than one lift. The first lift to provide at least 4 inch thickness under any portion of the pipe shall be placed before the pipe is installed and shall be spread smoothly so that the pipe is uniformly supported along the barrel. Subsequent lifts of not more than 6-inch thickness shall be placed to 6 inches over the crown on the pipe and individually compacted to 95% of maximum density. Material shall be gravel bedding material described in Section 312000.

3.4 PIPING INSTALLATION

- 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 into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Laying of storm sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared.
- C. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.

- D. Pipe laid shall be retained in position by mechanical means or otherwise, as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. Wherever moveable shoring (steel box) is used in the ditch, pipe shall be restrained by use of a winch mounted in the downstream manhole and a line of sufficient strength threaded through the pipe and set tightly before each move. Any indication that joints are not being adequately held shall be sufficient reason to require this or other equivalent method of restraint, whether or not moveable shoring is being used.
- E. 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.
- F. Variance from established line and grade shall not be greater than $\frac{1}{32}$ of an inch per inch of pipe diameter, not to exceed $\frac{1}{2}$ inch provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed $\frac{1}{64}$ inch per inch of pipe diameter, $\frac{1}{2}$ inch maximum.
- G. Install catch basins for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing storm sewer is indicated.
- H. Install 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.
- I. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- J. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with minimum cover as indicated on the plans.
 - 4. Install PVC storm sewer piping according to ASTM D 2321 and ASTM F 1668.
- K. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a temporary plug.
- L. As the pipe is installed, it shall be backfilled with the specified gravel bedding material up to an elevation 6 inches above the pipe crown, taking care that the gravel bedding is in contact with the entire periphery of the pipe. The gravel bedding shall be so carefully placed and firmly compacted that the subsequent backfilling operations will not disturb the pipe in any way.
- M. Pipe branches, stubs or other open ends that are not to be connected immediately shall be plugged with approved material consistent with these Specifications and secured in place.

3.5 PIPE JOINT CONSTRUCTION

- A. All extensions, additions and revisions of the storm sewer system, unless otherwise specified, shall be made with storm sewer pipe jointed by means of a flexible gasket which shall be fabricated and installed in accordance with these Specifications.
- B. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with dirt or other foreign material. Any gaskets so disturbed shall be removed and replaced, cleaned and re-lubricated if required before the jointing is attempted.
- C. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.
- D. Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted.
- E. At the end of the work day, the last pipe laid shall be blocked to prevent creep during "down time."
- F. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC storm sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 - 2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from storm water pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in stormwater pipe.
- B. Set cleanout frames and covers in earth. Set with tops 1 inch (25 mm) above surrounding earth grade.

3.7 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
- C. Construction details for catch basins and inlets shall follow all applicable provisions for construction of manholes.

- D. Backfill around catch basins shall be placed around the catch basins and compacted in successive layers six (6) inches in thickness and up to six (6) inches over the crown of the highest pipe connected to the catch basin.
- E. The inlet frame may be either cast into a concrete collar or set flange down on concrete adjustment blocks and mortared.
- F. Inlet frame shall not be grouted to final grade until the final elevation of the pavement, gutter, ditch or sidewalk in which it is to be placed has been established.
- G. Location of catch basins will be staked by the Engineer.
- H. All openings in the walls of catch basins constructed with precast sections for the insertion of pipe connections and outlet trap castings shall, after pipe or castings have been placed to their final position, be grouted tightly in place to present an inside and outside surface conforming to the Standard Details.
- I. The spigot end of the pipe shall be cut square with the last point of contact with the inside wall surface.

3.8 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - 1. Remove manhole or structure and close open ends of remaining piping.
 - 2. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Section 31 20 00 "Earth Moving."

3.9 IDENTIFICATION

- A. Materials and their installation are specified in Section 33 05 26 "Utility Identification".

3.10 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects with a minimum 4 PSI low pressure air test.
1. Leaks and loss in test pressure constitute defects that must be repaired.
- C. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.11 CLEANING

- A. Before acceptance testing is performed, the pipe installation should be reasonably clean. The pipe shall be cleaned either before or after testing the pipe in the following or equivalent manner.
- B. The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction and/or repair any damaged pipe. All visible leaks showing flowing water in pipelines or manholes shall be stopped even if the test results fall within the allowable leakage.

3.12 LEAKAGE TESTING

- A. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F1417, as applicable based on pipe material, with holding time not less than that listed in Table 2 in the attached Schedule.
1. Air testing for sections of pipe shall be limited to lines less than 27-inch average inside diameter.
 2. For pipe sections less than 27-inch average inside diameter:
 - a. Determine ground water level.
 - b. Plug both ends of pipe.
 - c. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust

pressure to start at 3.5 psig (plus adjustment for ground water table). See Table attached at end of section..

- d. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 2 for pipe diameter and length.
- B. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.13 DEFLECTION TEST FOR FLEXIBLE PIPE

- A. Initial test shall be visual inspection by inspector or Owner's agent verifying full visible round diameter of outlet (full moon). If pipe passes visual test, then mandrel testing is not required.
- B. If pipe fails visual test, then perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- C. Testing shall be conducted on a cleanout to cleanout basis and shall be done after the line has been completely flushed out with water.
- D. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- A. Contractor will be required, at his expense, to locate and repair any sections failing to pass the test.
- B. Retest repaired, replaced, re-excavated, or re-compacted sewer sections .

3.14 VIDEO INSPECTION

- A. The Owner requires all storm sewers to be inspected by the use of a video camera before final acceptance. The costs incurred in making the inspection shall be borne by the Contractor.
- B. A device will be attached in front of the camera to measure the depth of any ponding water.
- C. Any observed defects or ponded water with a depth of over 3/4 inch shall be cause for the rejection of the line.
- D. The Contractor shall bear all costs incurred in correcting any deficiencies found during television inspection including the cost of any additional television inspection that may be required by the Owner to verify the correction of said deficiency.
- E. The Contractor shall be responsible for all costs incurred in any video inspection performed solely for the benefit of the Contractor.
- F. Video equipment shall consist of a self-contained camera and a monitoring unit connected by three wire coaxial cable.

- G. Camera shall be small enough to ensure passage through a six-inch diameter storm sewer, shall be waterproof, and shall have a self-continuous 650-line resolution picture showing the entire inside periphery of the pipe.
- H. Furnish video recordings of the storm sewer lines on CD, DVD or flash drive in MP4 or similar file format readable by Windows Media Player or Quicktime software.
- I. Video inspection shall be performed on one manhole section at a time by propelling the television camera through the line along the axis of the pipe. The inspection shall be performed in a forward (upstream) direction, unless otherwise allowed by the Owner.
- J. Video inspection shall result in a continuous recording, beginning with the camera above grade with a pan view of the immediate vicinity of the originating manhole, then continuing while camera is placed in storm sewer and advanced to end manhole or segment being inspected.
- K. The video inspection shall be done at a speed (maximum 0.5 feet per second) and quality that allows the Owner to identify all pipe defects and storm sewer branches.

3.15 REPAIRS

- A. Any pipe or appurtenance which has been laid or jointed that is not in conformance with the Specifications shall be repaired or be removed and replaced at the expense of the Contractor.
- B. Any concrete pipe or manhole with any continuous crack having a surface width of 0.01 inch or more extending for a length of 12 inches or more regardless of position in the wall of the pipe or main shall be removed and replaced.
- C. Repair bands or clamps or concrete collars shall not be used to repair defective pipe.

END OF SECTION 33 41 00

LOW PRESSURE AIR TEST FOR PVC PIPE

Test Parameters (Pursuant to ASTM F1417-11a)**Test Time:** Minimum specified time required for a 0.5 PSIG Pressure Drop of Size and Length of Pipe**Indicated for Q = 0.0015 (Double the times below if 1.0 psig drop is to be used)**

Nominal Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length, L (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190*L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427*L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760*L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187*L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709*L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671*L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846*L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235*L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837*L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653*L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683*L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926*L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384*L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942*L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352*L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618*L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:20	40	42.738*L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

Minimum Test Pressure Table (Pursuant to ASTM 1417-92)

Groundwater Above Pipe Crown (ft)	Pressure (psi)	Groundwater Above Pipe Crown (ft)	Pressure (psi)
0	4.00	3	5.29
1	4.43	4	5.72
2	4.86	5	6.15