SECTION 000107 – SEALS PAGE

DESIGN PROFESSIONALS OF RECORD
Architect:
Neighboring Concepts

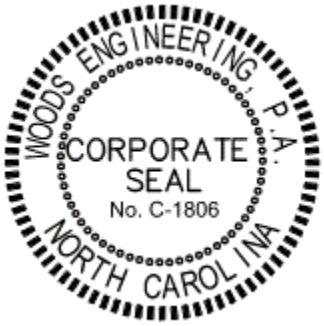




08/31/2022

Responsible for Divisions 00-13 Sections, except where indicated as prepared by other design professionals of record.

Structural Engineer:
Woods Engineering





08/31/2022

Responsible for Sections 033000, 051200, 052100, 053100, 054000

Plumbing Engineer:
CMTA



08/31/2022

Responsible for Division 22

Mechanical Engineer:
CMTA



08/31/2022

Responsible for Division 23

Electrical Engineer:
CMTA



08/31/2022

Responsible for Divisions 26

PROJECT MANUAL

Novant Health Family Medical Clinic – Greenfield St.

Wilmington, North Carolina

Project No: 21-025



Construction Documents

August 31, 2022

PROJECT MANUAL
NOVANT HEALTH FAMILY MEDICAL CLINIC – GREENFIELD ST.

New Construction at
1423 Greenfield Street
Wilmington, NC 28401

DIVISIONS 00 THROUGH 28

PROJECT 21-025

August 31, 2022

TITLE PAGE

TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 000107 – SEALS PAGE
SECTION 000130 – SUPPLIER DIVERSITY IN CONSTRUCTION STATEMENT
SECTION 003132 – GEOTECHNICAL DATA
SECTION 005200 – FORM OF AGREEMENT (AIA DOCUMENT A101-2017)
SECTION 005210 – GENERAL CONDITIONS (AIA DOCUMENT A201-2017)
SECTION 005220 – SUPPLEMENTARY CONDITIONS

FORMS:
SECTION 006010 – AFFIDAVIT OF PRIME CONTRACTOR
SECTION 006020 – RELEASE AND WAIVER OF CLAIM
SECTION 006030 – ASBESTOS-FREE WARRANTY
SECTION 006040 – CONTRACTOR'S GENERAL WARRANTY
SECTION 006050 – SUBMITTAL DATA FORM
SECTION 006060 – REQUEST FOR SUBSTITUTIONS
SECTION 006070 – WARRANTEES AND BONDS

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 011000 – SUMMARY
SECTION 012100 – ALLOWANCES
SECTION 012200 – UNIT PRICES
SECTION 012500 - SUBSTITUTION PROCEDURES
SECTION 012600 - CONTRACT MODIFICATION PROCEDURES
SECTION 012900 - PAYMENT PROCEDURES
SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION
SECTION 013300 - SUBMITTAL PROCEDURES
SECTION 014000 - QUALITY REQUIREMENTS
SECTION 016000 - PRODUCT REQUIREMENTS
SECTION 017300 - EXECUTION
SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
SECTION 017700 - CLOSEOUT PROCEDURES
SECTION 017823 - OPERATION AND MAINTENANCE DATA
SECTION 017839 - PROJECT RECORD DOCUMENTS

DIVISION 03 – CONCRETE

SECTION 033000 – CAST-IN-PLACE CONCRETE

DIVISION 04 – MASONRY

SECTION 042000 – UNIT MASONRY

DIVISION 05 – METALS

SECTION 051200 – STRUCTURAL STEEL FRAMING
SECTION 052100 – STEEL JOIST FRAMING
SECTION 053100 – STEEL DECKING
SECTION 054000 – COLD-FORMED METAL FRAMING
SECTION 055000 – METAL FABRICATIONS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

SECTION 061000 – ROUGH CARPENTRY
SECTION 061600 – SHEATHING
SECTION 061613 – STRUCTURAL INSULATED SHEATHING
SECTION 062000 – FINISH CARPENTRY
SECTION 064116 – INTERIOR ARCHITECTURAL WOODWORK
SECTION 068300 – SOLID POLYMER FABRICATIONS

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 072100 – THERMAL INSULATION
SECTION 072670.13 – BELOW SLAB VAPOR RETARDERS
SECTION 074213.13 – FORMED METAL WALL PANELS
SECTION 074243.13 – WOOD VENEER LAMINATE SLATS
SECTION 075423 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
SECTION 076200 – SHEET METAL FLASHING AND TRIM
SECTION 077100 – ROOF SPECIALTIES
SECTION 077200 – ROOF ACCESSORIES
SECTION 079200 – JOINT SEALANTS

DIVISION 08 - OPENINGS

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES
SECTION 081416 – FLUSH WOOD DOORS
SECTION 083213 – SLIDING ALUMINUM-FRAMED GLASS DOORS
SECTION 084113 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
SECTION 084413 – GLAZED ALUMINUM CURTAIN WALLS
SECTION 087100 – DOOR HARDWARE
SECTION 088000 – GLAZING
SECTION 088300 - MIRRORS

DIVISION 09 - FINISHES

SECTION 092116 – GYPSUM BOARD ASSEMBLIES
SECTION 095113 – ACOUSTICAL PANEL CEILINGS
SECTION 096519 - RESILIENT TILE FLOORING
SECTION 096813 – TILE CARPETING
SECTION 099113 – EXTERIOR PAINTING
SECTION 099123 – INTERIOR PAINTING

DIVISION 10 – SPECIALTIES

SECTION 102113 – TOILET COMPARTMENTS
SECTION 102601 – WALL AND CORNER GUARDS
SECTION 102800 – TOILET AND LAUNDRY ACCESSORIES
SECTION 104400 – FIRE EXTINGUISHER CABINETS AND EXTINGUISHERS
SECTION 107326 – WALKWAY COVERINGS

DIVISION 11 – EQUIPMENT

SECTION 117100 – MEDICAL EQUIPMENT

DIVISION 12 – FURNISHINGS (NOT USED)

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 134905 – X-RAY RADIATION PROTECTION

DIVISION 22 – PLUMBING

SECTION 220100 – GENERAL PROVISIONS - PLUMBING
SECTION 220208 - PLUMBING IDENTIFICATION AND PAINTING
SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING
SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING
SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING
SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
SECTION 220719 - PLUMBING PIPING INSULATION
SECTION 221116 - DOMESTIC WATER PIPING
SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES
SECTION 221316 - SANITARY WASTE AND VENT PIPING
SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES
SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS
SECTION 224213.13 - COMMERCIAL WATER CLOSETS
SECTION 224216.13 - COMMERCIAL LAVATORIES
SECTION 224216.16 - COMMERCIAL SINKS
SECTION 224500 - EMERGENCY PLUMBING FIXTURES
SECTION 229000 - PROJECT CLOSEOUT

DIVISION 23 – MECHANICAL

SECTION 230100 – GENERAL PROVISIONS – MECHANICAL
SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC
SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
SECTION 230713 - DUCT INSULATION
SECTION 230719 - HVAC PIPING INSULATION
SECTION 232113 - REFRIGERANT, CONDENSATE PIPE AND PIPE FITTINGS
SECTION 233113 - METAL DUCTS
SECTION 233300 - AIR DUCT ACCESSORIES
SECTION 233416 - CENTRIFUGAL HVAC FANS
SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES
SECTION 237070 – PACKAGED ROOFTOP HEATING AND COOLING UNITS
SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONING UNITS
SECTION 239000 – PROJECT CLOSEOUT
SECTION 239800 – TESTING AND BALANCING SYSTEMS
SECTION 239850 – SYSTEM TESTING, CLEANING AND START-UP
SECTION 239860 – OPERATION AND MAINTENANCE DATA
SECTION 239900 – COMMISSIONING OF MECHANICAL SYSTEMS

DIVISION 26 - ELECTRICAL

SECTION 260100 - GENERAL PROVISIONS – ELECTRICAL
SECTION 260126 - DIVISION OF WORK (DIVISIONS 22, 23, 26, AND 28)
SECTION 260234 - ELECTRICAL CONNECTIONS
SECTION 260519 - CONDUCTORS
SECTION 260526 - GROUNDING AND BONDING SYSTEMS
SECTION 260529 - SUPPORTS AND FASTENERS
SECTION 260530 - CONDUIT
SECTION 260537 - SLEEVES AND PENETRATIONS
SECTION 260541 - BOXES AND ENCLOSURES
SECTION 260543 - UNDERGROUND SITE RACEWAY AND DUCTBANK SYSTEMS
SECTION 260545 - FIRE SEALS
SECTION 260553 - NAMEPLATES AND SIGNS
SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE COORDINATION
SECTION 262416 - PANELBOARDS
SECTION 262726 - WIRING DEVICES
SECTION 262727 - COVER PLATES
SECTION 262813 - FUSES
SECTION 262816 - SAFETY DISCONNECT SWITCHES
SECTION 263200 - STANDBY POWER SYSTEMS
SECTION 263214 - AUTOMATIC TRANSFER SWITCHES
SECTION 264100 - FACILITY LIGHTNING PROTECTION
SECTION 264300 - SURGE PROTECTIVE DEVICES

SECTION 265000 - BUILDING LUMINAIRES
SECTION 265400 - OCCUPANCY SENSOR LIGHTING CONTROL SYSTEMS
SECTION 269000 - PROJECT CLOSEOUT
SECTION 269990 - ALTERNATES

DIVISION 28 – FIRE ALARM (NOT USED)

SECTION 283100 – FIRE DETECTTION AND ALARM (NOT USED)

SECTION 000130 – SUPPLIER DIVERSITY IN CONSTRUCTION STATEMENT

Supplier Diversity in Construction Statement

It is the intent of Novant Health and the contractors and sub-contractors performing the construction contracts awarded that they shall cooperate and in good faith do all things legal, proper and reasonable to encourage the participation of diverse contractors in each construction project. Nothing in these guidelines shall be construed to require contractors to award contracts or subcontracts to or to make purchases of materials or equipment from diverse contractors who do not submit the lowest responsible, responsive bid.

Novant defines a "diverse" contractor as being a company that is ethnic minority, woman, veteran or disabled owned. The company must be at least 51% owned, operated and controlled by one or more persons defined as "diverse."

Contractors shall identify their good faith effort in their proposal according to Appendix W, X and Y. If awarded a contract, contractors shall be required to report their diverse contractor spend according to Appendix Z.

SECTION 003132 – GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. "Geotechnical Engineering Report, Greenfield Street Site" Engineer / Consultant's Project Number: _____

2. Copy of the geotechnical report is included in the Project Manual.

1.2 REPORTS AND ANALYSIS

A. All reports are made a part of this section by inclusion or reference, enabling the Contractor and all parties to the construction to have the same information available to the Owner, Architect, and Consultants regarding the subsurface conditions.

B. This information shall not be a substitute for the Contractors personal investigation or judgment of actual conditions at the site. If the Contractors require additional subsurface information, it may be obtained at the Contractors expense with the Owners approval.

C. Variations:

1. The nature of variations may not become evident until construction begins. Should subsurface conditions differ significantly from the information in the reports included at the end of this section, the Contractor shall immediately notify the Architect verbally, followed by a written notification

2. No change in the Contract Time or Contract Sum will be considered without an executed Change Order.

D. Regardless of the thoroughness of the geotechnical explorations, possibilities exists that subsurface conditions will differ from those at the boring locations or will not be as anticipated by the design professionals. Therefore, the Architect, Owner, and the Consulting Engineers assumes no responsibility for the accuracy of the information in the geotechnical reports and shall be held harmless for any claims by the Contractor, or others, because of errors in the reports.

END OF SECTION 003132

SECTION 005200 – FORM OF AGREEMENT (AIA DOCUMENT A101-2017)

FORM OF AGREEMENT

AIA DOCUMENT A101 - 2017, STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR, WILL BE INCLUDED IN THE BID DOCUMENTS TO PROVIDE INFORMATION TO POTENTIAL BIDDERS REGARDING THE CONTRACTUAL AGREEMENT WITH THE OWNER. A DRAFT COPY OF THIS DOCUMENT IS INCLUDED IN THE PROJECT MANUAL.

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 « »
(In words, indicate day, month and year.)

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

« »« »
« »
« »
« »

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

« »« »
« »
« »
« »

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

« »
« »
« »

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

« »« »
« »
« »
« »

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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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

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.)

« »

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.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

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[« »] 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.

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.)

« »

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

« »

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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 « » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « » day of the « » 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 « » (« ») 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.)

« »

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§ 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.)

« » % « »

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.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[« »] Litigation in a court of competent jurisdiction

[« »] 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)

« »
« »
« »
« »
« »
« »

§ 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.

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§ 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 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.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.)

« »

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[« »] The Sustainability Plan:

Title	Date	Pages

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

Document	Title	Date	Pages

.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)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

DRAFT

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SECTION 005210 – GENERAL CONDITIONS (AIA DOCUMENT A201-2017)

GENERAL CONDITIONS

AIA DOCUMENT A201 - 2017, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, WILL BE INCLUDED IN THE BID DOCUMENTS TO PROVIDE INFORMATION TO POTENTIAL BIDDERS REGARDING THE GENERAL CONDITIONS OF THE CONTRACT. A DRAFT COPY OF THIS DOCUMENT IS INCLUDED IN THE PROJECT MANUAL.

DRAFT

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

« »
« »

THE OWNER:
(Name, legal status and address)

« »« »
« »

THE ARCHITECT:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 OWNER

3 CONTRACTOR

4 ARCHITECT

5 SUBCONTRACTORS

6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7 CHANGES IN THE WORK

8 TIME

9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

11 INSURANCE AND BONDS

12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

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.

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

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INDEX
(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work
9.6.6, 9.9.3, **12.3**
Acceptance of Work
9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3
Access to Work
3.16, 6.2.1, 12.1
Accident Prevention
10
Acts and Omissions
3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5, 10.2.8, 13.3.2, 14.1, 15.1.2, 15.2
Addenda
1.1.1
Additional Costs, Claims for
3.7.4, 3.7.5, 10.3.2, 15.1.5
Additional Inspections and Testing
9.4.2, 9.8.3, 12.2.1, **13.4**
Additional Time, Claims for
3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**
Administration of the Contract
3.1.3, **4.2**, 9.4, 9.5
Advertisement or Invitation to Bid
1.1.1
Aesthetic Effect
4.2.13
Allowances
3.8
Applications for Payment
4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10
Approvals
2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9, 3.12.10.1, 4.2.7, 9.3.2, 13.4.1
Arbitration
8.3.1, 15.3.2, **15.4**
ARCHITECT
4
Architect, Definition of
4.1.1
Architect, Extent of Authority
2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2, 9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1
Architect, Limitations of Authority and Responsibility
2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2
Architect's Additional Services and Expenses
2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4
Architect's Administration of the Contract
3.1.3, 3.7.4, 15.2, 9.4.1, 9.5
Architect's Approvals
2.5, 3.1.3, 3.5, 3.10.2, 4.2.7
Architect's Authority to Reject Work
3.5, 4.2.6, 12.1.2, 12.2.1
Architect's Copyright
1.1.7, 1.5
Architect's Decisions
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1, 13.4.2, 15.2
Architect's Inspections
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4
Architect's Instructions
3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2
Architect's Interpretations
4.2.11, 4.2.12
Architect's Project Representative
4.2.10
Architect's Relationship with Contractor
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2
Architect's Relationship with Subcontractors
1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3
Architect's Representations
9.4.2, 9.5.1, 9.10.1
Architect's Site Visits
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Asbestos
10.3.1
Attorneys' Fees
3.18.1, 9.6.8, 9.10.2, 10.3.3
Award of Separate Contracts
6.1.1, 6.1.2
Award of Subcontracts and Other Contracts for Portions of the Work
5.2
Basic Definitions
1.1
Bidding Requirements
1.1.1
Binding Dispute Resolution
8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1
Bonds, Lien
7.3.4.4, 9.6.8, 9.10.2, 9.10.3
Bonds, Performance, and Payment
7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**
Building Information Models Use and Reliance
1.8
Building Permit
3.7.1
Capitalization
1.3
Certificate of Substantial Completion
9.8.3, 9.8.4, 9.8.5
Certificates for Payment
4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4
Certificates of Inspection, Testing or Approval
13.4.4

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Certificates of Insurance
9.10.2
Change Orders
1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2
Change Orders, Definition of
7.2.1
CHANGES IN THE WORK
2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5
Claims, Definition of
15.1.1
Claims, Notice of
1.6.2, 15.1.3
CLAIMS AND DISPUTES
3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4
Claims and Timely Assertion of Claims
15.4.1
Claims for Additional Cost
3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**
Claims for Additional Time
3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**
Concealed or Unknown Conditions, Claims for
3.7.4
Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7
Claims Subject to Arbitration
15.4.1
Cleaning Up
3.15, 6.3
Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**
Commencement of the Work, Definition of
8.1.2
Communications
3.9.1, **4.2.4**
Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2
COMPLETION, PAYMENTS AND
9
Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3
Concealed or Unknown Conditions
3.7.4, 4.2.8, 8.3.1, 10.3
Conditions of the Contract
1.1.1, 6.1.1, 6.1.4
Consent, Written
3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2
Consolidation or Joinder
15.4.4
CONSTRUCTION BY OWNER OR BY
SEPARATE CONTRACTORS
1.1.4, **6**
Construction Change Directive, Definition of
7.3.1
Construction Change Directives
1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1
Construction Schedules, Contractor's
3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Contingent Assignment of Subcontracts
5.4, 14.2.2.2
Continuing Contract Performance
15.1.4
Contract, Definition of
1.1.2
CONTRACT, TERMINATION OR
SUSPENSION OF THE
5.4.1.1, 5.4.2, 11.5, **14**
Contract Administration
3.1.3, 4, 9.4, 9.5
Contract Award and Execution, Conditions Relating to
3.7.1, 3.10, 5.2, 6.1
Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3
Contract Documents, Definition of
1.1.1
Contract Sum
2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5, 15.2.5**
Contract Sum, Definition of
9.1
Contract Time
1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5
Contract Time, Definition of
8.1.1
CONTRACTOR
3
Contractor, Definition of
3.1, 6.1.2
Contractor's Construction and Submittal
Schedules
3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2
Contractor's Employees
2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1
Contractor's Liability Insurance
11.1
Contractor's Relationship with Separate Contractors and Owner's Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

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Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4
Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1
Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2
Contractor's Responsibility for Those Performing the Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8
Contractor's Review of Contract Documents
3.2
Contractor's Right to Stop the Work
2.2.2, 9.7
Contractor's Right to Terminate the Contract
14.1
Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3
Contractor's Superintendent
3.9, 10.2.6
Contractor's Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4
Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1
Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11
Copyrights
1.5, **3.17**
Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1
Correlation and Intent of the Contract Documents
1.2
Cost, Definition of
7.3.4
Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14
Cutting and Patching
3.14, 6.2.5
Damage to Construction of Owner or Separate Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7
Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2
Date of Commencement of the Work, Definition of
8.1.2
Date of Substantial Completion, Definition of
8.1.3
Day, Definition of
8.1.4
Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2
Decisions to Withhold Certification
9.4.1, **9.5**, 9.7, 14.1.1.3
Defective or Nonconforming Work, Acceptance, Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1
Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1
Delays and Extensions of Time
3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**, 10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5
Digital Data Use and Transmission
1.7
Disputes
6.3, 7.3.9, 15.1, 15.2
Documents and Samples at the Site
3.11
Drawings, Definition of
1.1.5
Drawings and Specifications, Use and Ownership of
3.11
Effective Date of Insurance
8.2.2
Emergencies
10.4, 14.1.1.2, **15.1.5**
Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1
Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4
Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, **15.2.5**
Failure of Payment
9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Faulty Work
(See Defective or Nonconforming Work)
Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3
Financial Arrangements, Owner's
2.2.1, 13.2.2, 14.1.1.4

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GENERAL PROVISIONS
1
Governing Law
13.1
Guarantees (See Warranty)
Hazardous Materials and Substances
10.2.4, **10.3**
Identification of Subcontractors and Suppliers
5.2.1
Indemnification
3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3
Information and Services Required of the Owner
2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5, 9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4
Initial Decision
15.2
Initial Decision Maker, Definition of
1.1.8
Initial Decision Maker, Decisions
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Initial Decision Maker, Extent of Authority
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Injury or Damage to Person or Property
10.2.8, 10.4
Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 12.2.1, 13.4
Instructions to Bidders
1.1.1
Instructions to the Contractor
3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2
Instruments of Service, Definition of
1.1.7
Insurance
6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, **11**
Insurance, Notice of Cancellation or Expiration
11.1.4, 11.2.3
Insurance, Contractor's Liability
11.1
Insurance, Effective Date of
8.2.2, 14.4.2
Insurance, Owner's Liability
11.2
Insurance, Property
10.2.5, 11.2, 11.4, 11.5
Insurance, Stored Materials
9.3.2
INSURANCE AND BONDS
11
Insurance Companies, Consent to Partial Occupancy
9.9.1
Insured loss, Adjustment and Settlement of
11.5
Intent of the Contract Documents
1.2.1, 4.2.7, 4.2.12, 4.2.13
Interest
13.5
Interpretation
1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1
Interpretations, Written
4.2.11, 4.2.12
Judgment on Final Award
15.4.2
Labor and Materials, Equipment
1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Labor Disputes
8.3.1
Laws and Regulations
1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8, 15.4
Liens
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Limitations, Statutes of
12.2.5, 15.1.2, 15.4.1.1
Limitations of Liability
3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6, 4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3, 11.3, 12.2.5, 13.3.1
Limitations of Time
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7, 5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15, 15.1.2, 15.1.3, 15.1.5
Materials, Hazardous
10.2.4, **10.3**
Materials, Labor, Equipment and
1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2
Means, Methods, Techniques, Sequences and Procedures of Construction
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2
Mechanic's Lien
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Mediation
8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1, 15.4.1.1
Minor Changes in the Work
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**
MISCELLANEOUS PROVISIONS
13
Modifications, Definition of
1.1.1
Modifications to the Contract
1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2
Mutual Responsibility
6.2
Nonconforming Work, Acceptance of
9.6.6, 9.9.3, **12.3**

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Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2
Notice
1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1
Notice of Cancellation or Expiration of Insurance
11.1.4, 11.2.3
Notice of Claims
1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1
Notice of Testing and Inspections
13.4.1, 13.4.2
Observations, Contractor's
3.2, 3.7.4
Occupancy
2.3.1, 9.6.6, 9.8
Orders, Written
1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1
OWNER
2
Owner, Definition of
2.1.1
Owner, Evidence of Financial Arrangements
2.2, 13.2.2, 14.1.1.4
Owner, Information and Services Required of the
2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4
Owner's Authority
1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7
Owner's Insurance
11.2
Owner's Relationship with Subcontractors
1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2
Owner's Right to Carry Out the Work
2.5, 14.2.2
Owner's Right to Clean Up
6.3
Owner's Right to Perform Construction and to Award Separate Contracts
6.1
Owner's Right to Stop the Work
2.4
Owner's Right to Suspend the Work
14.3
Owner's Right to Terminate the Contract
14.2, 14.4
Ownership and Use of Drawings, Specifications and Other Instruments of Service
1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3
Partial Occupancy or Use
9.6.6, **9.9**
Patching, Cutting and
3.14, 6.2.5
Patents
3.17
Payment, Applications for
4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3
Payment, Certificates for
4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4
Payment, Failure of
9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Payment, Final
4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3
Payment Bond, Performance Bond and
7.3.4.4, 9.6.7, 9.10.3, **11.1.2**
Payments, Progress
9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4
PAYMENTS AND COMPLETION
9
Payments to Subcontractors
5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2
PCB
10.3.1
Performance Bond and Payment Bond
7.3.4.4, 9.6.7, 9.10.3, **11.1.2**
Permits, Fees, Notices and Compliance with Laws
2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2
PERSONS AND PROPERTY, PROTECTION OF
10
Polychlorinated Biphenyl
10.3.1
Product Data, Definition of
3.12.2
Product Data and Samples, Shop Drawings
3.11, **3.12**, 4.2.7
Progress and Completion
4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4
Progress Payments
9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4
Project, Definition of
1.1.4
Project Representatives
4.2.10
Property Insurance
10.2.5, **11.2**
Proposal Requirements
1.1.1
PROTECTION OF PERSONS AND PROPERTY
10

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Regulations and Laws
1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4
Rejection of Work
4.2.6, 12.2.1
Releases and Waivers of Liens
9.3.1, 9.10.2
Representations
3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1
Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1
Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field Conditions by Contractor
3.2, 3.12.7, 6.1.3
Review of Contractor's Submittals by Owner and Architect
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples by Contractor
3.12
Rights and Remedies
1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2, 12.2.4, **13.3**, 14, 15.4
Royalties, Patents and Copyrights
3.17
Rules and Notices for Arbitration
15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3, **10.1**, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
3.11, **3.12**, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2
Separate Contractors, Definition of
6.1.1
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
3.11, **3.12**, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4
Site Visits, Architect's
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Special Inspections and Testing
4.2.6, 12.2.1, 13.4
Specifications, Definition of
1.1.6
Specifications
1.1.1, **1.1.6**, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14
Statute of Limitations
15.1.2, 15.4.1.1
Stopping the Work
2.2.2, 2.4, 9.7, 10.3, 14.1
Stored Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5
Subcontractors, Work by
1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1
Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3
Submittal Schedule
3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
6.1.1, **11.3**
Substances, Hazardous
10.3
Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8**, 9.9.1, 9.10.3, 12.2, 15.1.2
Substantial Completion, Definition of
9.8.1
Substitution of Subcontractors
5.2.3, 5.2.4
Substitution of Architect
2.3.3
Substitutions of Materials
3.4.2, 3.5, 7.3.8
Sub-subcontractor, Definition of
5.1.2
Subsurface Conditions
3.7.4
Successors and Assigns
13.2
Superintendent
3.9, 10.2.6
Supervision and Construction Procedures
1.2.2, **3.3**, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4
Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1

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Surety
5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7
Surety, Consent of
9.8.5, 9.10.2, 9.10.3
Surveys
1.1.7, 2.3.4
Suspension by the Owner for Convenience
14.3
Suspension of the Work
3.7.5, 5.4.2, 14.3
Suspension or Termination of the Contract
5.4.1.1, 14
Taxes
3.6, 3.8.2.1, 7.3.4.4
Termination by the Contractor
14.1, 15.1.7
Termination by the Owner for Cause
5.4.1.1, **14.2,** 15.1.7
Termination by the Owner for Convenience
14.4
Termination of the Architect
2.3.3
Termination of the Contractor Employment
14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT
14
Tests and Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, **13.4**
TIME
8
Time, Delays and Extensions of
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, **8.3**, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5
Time Limits
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4
Time Limits on Claims
3.7.4, 10.2.8, 15.1.2, 15.1.3
Title to Work
9.3.2, 9.3.3
UNCOVERING AND CORRECTION OF WORK
12
Uncovering of Work
12.1
Unforeseen Conditions, Concealed or Unknown
3.7.4, 8.3.1, 10.3
Unit Prices
7.3.3.2, 9.1.2
Use of Documents
1.1.1, 1.5, 2.3.6, 3.12.6, 5.3
Use of Site
3.13, 6.1.1, 6.2.1
Values, Schedule of
9.2, 9.3.1
Waiver of Claims by the Architect
13.3.2
Waiver of Claims by the Contractor
9.10.5, 13.3.2, **15.1.7**
Waiver of Claims by the Owner
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, **15.1.7**
Waiver of Consequential Damages
14.2.4, 15.1.7
Waiver of Liens
9.3, 9.10.2, 9.10.4
Waivers of Subrogation
6.1.1, **11.3**
Warranty
3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2
Weather Delays
8.3, 15.1.6.2
Work, Definition of
1.1.3
Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2
Written Interpretations
4.2.11, 4.2.12
Written Orders
1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

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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.

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§ 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

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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.

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§ 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

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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.

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§ 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.

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§ 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.

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§ 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

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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

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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

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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.

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§ 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.

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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.

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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.

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§ 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.

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§ 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

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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.

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§ 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.

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§ 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.

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§ 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

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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

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(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

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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

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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

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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.

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§ 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:

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.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.

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§ 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

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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.

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§ 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.

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SECTION 005220 – SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY CONDITIONS

The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction". AIA Document A201, 2017 Edition. Where any article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

Article 1 - General Provisions

1.1. Basic Definitions

Add the following to Subparagraph 1.1.1:

"Precedence of Contract Documents shall be in the following sequence:

1) Agreement (Between Owner and Contractor)
2) Addenda
3) Supplementary General Conditions
4) General Conditions (AIA Document A201)
5) Specifications and Related Documents
6) Working Drawings, wherein precedence shall be large scale drawings, over small scale, figured dimensions over scaled dimensions, and noted materials over graphic indications."

Add the following to Subparagraph 1.1.3:

"Provided" shall mean furnish, fabricate, erect, and completely install, including all necessary labor and incidental materials, the referenced or described item complete in place and ready for use or operation."

Add the following to Subparagraph 1.1.5:

"Mechanical, Plumbing, and Electrical Drawings are diagrammatic only. Actual work shall be installed in accordance with measurements obtained at job-site, coordination with other trades as necessary, and shop drawing requirements."

Article 3 - Contractor

3.2 Review of Contract Documents and Field Conditions by Contractor.

Add the following to Subparagraph 3.2.2:

"The Contractor shall assume full responsibility for accuracy of measurements obtained at the site. No extra compensation will be allowed because of differences between actual measurements and dimensions indicated on the Drawings, nor for Contractor's failure to coordinate work with actual field measurements."

Modify Subparagraph 3.3.4 as follows:

"The Contractor shall be responsible for inspection of portions of work already performed under this contract by the Contractor and/or his subcontractors to determine that such portions are in proper condition to receive subsequent work."

3.4 Labor and Materials

Add the following Subparagraph 3.4.4 to Paragraph 3.4:

"3.4.4 The Contractor shall keep the Architect informed as to the availability of all specified materials and equipment and shall advise him promptly, in writing, of all materials and equipment that may not be obtainable for the purposes of the Contract, whether due to conditions of the market or other limiting or governing factors."

3.5 Warranty

Add the following to Subparagraph 3.5.1:
"The Contractor shall bear all expenses resulting from substitutions including the cost of work in general, structural, plumbing, mechanical and electrical trades required due to the substitution and the cost of any Architect's services made necessary by the substitution."

3.6 Taxes

Add the following to Subparagraph 3.6.1:

"The Contractor shall not include local and state sales, consumer, use and similar taxes in the Contract Sum. However, he shall pay such taxes at the time they are due. He shall provide the Owner with an itemized listing and supporting data for all such taxes paid, and the Owner shall reimburse the Contractor for such payments. Supporting documentation shall be in conformance with requirements of the State of North Carolina."

3.7 Permits, Fees, Notices and Compliance with Laws:

Add the following to Subparagraph 3.7.1:

"Upon completion of the Work, the Contractor shall deliver to the Architect original copies of all required certificates of inspection."

3.10 Contractor's Construction Schedules

Add the following Sub-Subparagraph 3.10.1.1 to Subparagraph 3.10.1:

"3.10.1.1 Immediately following Contract Award, the Contractor shall hold a meeting for the purpose of establishing and preparing a Construction Progress Schedule. Each major subcontractor shall be represented.

The Construction Progress Schedule shall be detailed to a degree which will permit proper and complete coordination of all trades in each portion of the work, including adequate time for start-up of equipment, reviews, and necessary correction of deficiencies. Therefore, the schedule shall specifically indicate the following dates:

The date of satisfactory enclosure.

The date of transfer of responsibility for temporary heat from the General Contractor to the Mechanical Contractor.

Dates scheduled for delivery of major items of equipment.

Dates scheduled for completion of installation of major items of equipment.

The anticipated date of Substantial Completion.

The date of Final Completion of the project, as established by the Contract.

The complete Construction Progress Schedule, bearing the approval signature of the Contractor and major subcontractors, shall be distributed to all interested parties in quantities as required.
At the time of submitting the Construction Progress Schedule to the Architect, the
Contractor shall also submit the anticipated amount of each monthly payment that will become due in accordance with the Progress Schedule.

No application for payment will be approved until the Construction Progress
Schedule has been received by the Architect."

Add the following Sub-Subparagraph 3.10.2.1 to Subparagraph 3.10.2:

"3.10.2.1 The Contractor shall prepare and submit to the Architect within 30 days after award of the Contract a schedule of Shop Drawings and Submittals as required in the Contract Documents. Schedule shall fix dates for submission, and the lead time for each submittal as related to requirements for return receipt for submittal to expedite delivery of material to maintain Progress Schedule. It is to be understood that this Schedule will be subject to change from time to time in accordance with the progress of the work. All Shop Drawings, Samples and Submittals for approval shall be completed within two months after award of the Contract."

3.11 Documents and Samples at the Site:

Add the following to Paragraph 3.11

"The Contractor shall record on the Record Drawings all changes and selections made during construction and shall locate by dimensions showing actual field measurements of all major items which will be concealed in the completed work. These items shall include underground piping and conduit beneath slabs-on-grade (or basement slabs), underground site utilities such as pipe, conduit, etc., and items above hard ceilings such as duct, pipe, etc.

3.12 Shop Drawings, Product Data and Samples:

Add the following to Subparagraph 3.12.5:

"Requirements regarding submittal of Shop Drawings, Samples, and related required submittals are specified in Division One of the Specifications."

Article 4 - Architect

4.1 General

Add the following to Subparagraph 4.1.1:
"The Architect as referred to in these documents is McCulloch England Associates Architects, 100 Queens Road, Charlotte, North Carolina 28204. The term "Architect" shall include the Architect's consultants and staff for all disciplines including structural, mechanical, plumbing, electrical, food service equipment, etc."

Article 5 - Subcontractors

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

Add the following to Subparagraph 5.2.1:

"The listing required by this subparagraph shall be submitted to the Architect not later than 30 days from the date of the Contract. This list shall include the names of manufacturers, suppliers, and installers proposed for each of the products, equipment, and materials to be incorporated into the project.

The Contractor shall furnish upon request adequate data on any named entity on the list in order to permit the Architect and Owner to conduct a proper evaluation. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents, and all products furnished by the listed manufacturer must conform to such requirements."

5.3 Subcontractural Relations

Add the following to Paragraph 5.3:

"The division of these specifications into sections is not intended to control the Contractor in dividing the work among the subcontractors nor to limit the scope of work performed by any trade under a given section. The Architect will not undertake to settle any differences between the Contractor and his Subcontractors as to inclusion of work or material items. It shall be the Contractor's entire responsibility for the proper coordination and completion of all the work described in these Specifications whether performed by the Contractor or Subcontractors, if any."

Article 7 - Changes in the Work:

7.2 Change Orders

Add the following Subparagraphs 7.2.2 and 7.2.3 to Paragraph 7.2:

"7.2.2 A change order, when issued, shall be full compensation, or credit, for the extra work included, omitted, or substituted. It shall show on its face, the adjustment in time for completion of the project as a result of the change in the work. Each change order shall include all costs related thereto, including all overhead, miscellaneous expenses, and incidentals. The Contractor shall submit a written and itemized proposal for each Change Order under consideration (Request For Change to the Contract Amount - RFC) within 21 days of receipt of a pricing request. The allowance for overhead and profit for changes shall be in accordance with the following schedule:

1. For the Contractor, for any Work performed by the Contractor's own forces, 15 percent of the cost for additive changes. Deduct 5 percent for deductive changes.

2. For the Contractor, for Work performed by his Subcontractor, 5 percent of the amount due the Subcontractor.

3. For each Subcontractor or Sub-subcontract involved, for any Work performed by his own forces, 15 percent of the cost.

4. For each Subcontractor, for Work performed by his Sub-subcontractor, 5 percent of the amount due the Sub-subcontractor.

5. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

6. All proposals shall be submitted in the following manner:

(a) Materials (itemized breakdown)	$_____
(b) Rent of Equipment (list separately) at rates not in excess of those prevailing in locality of the project.	$_____
Sub-Total (1)	$_____
(c) Labor (itemized breakdown)	$_____
Sub-Total (2)	$_____
(d) Overhead & Profit (15% x Sub-Total 1 and 2 for additive changes, -5% for deductive changes)	$_____
Sub-Total (3)	$_____
(e) Sub-Contract Work (if applicable, same breakdown as shown above)	$_____

Contractor's Overhead and Profit on Sub-Bid (5% for additive changes, 0% for deductive change)	$_____
Sub-Total (4)	$_____
(f) Insurance (Workman's Compensation, Social Security or as otherwise required and/or specified)	$_____
Sub-Total (5)	$_____
(g) Guarantee Bond (on Sub-Total 5)	$_____
TOTAL	$_____

"7.2.3 The Contractor shall be required, when requested by the Architect to provide proper back-up for materials, labor, insurance, workman's compensation, and any other line item as requested by the Architect.

Items as listed below and other related items shall not be a line item in the change order but shall be included in the Contractor's overhead and profit.

Small tools.
Supervisory labor including secretarial work.
Copies and mailing costs.
Telephone and long distance charges.
Tool and material distribution.
Extra charges for work in difficult areas unless previously approved by the Architect

Article 9 - Payments and Completion:

9.2 Schedule of Values

Add the following Sub-Subparagraphs 9.2.1, 9.2.2, and 9.2.3 to Subparagraph 9.2.1:

"9.2.1 In submitting the Schedule of Values, the Contractor shall be prepared to substantiate any line items in the Schedule of Values that may be questioned by the Architect. Items in question shall be substantiated by such data that may be required by the Architect to establish the reasonableness of the value assigned to the labor and/or materials for that item.

9.2.2 At the time of submitting the Schedule of Values, the Contractor shall also submit an estimate of the amount of each Request for Payment for the Owner's use in planning cash flow for the Project. It is understood that actual amounts requested by the Requests for Payment may not agree with this estimate."

9.2.3 The Schedule of values shall be submitted on the same AIA forms and in the identical format as will be used for Applications for Payment. For each item, the schedule of values shall show separate

line items for labor and for materials."

9.3 Applications for Payment

Add the following to Subparagraph 9.3.1:

"9.3.1.3 Requests for Payment shall be submitted in 3 copies (unless otherwise directed) to the Architect on forms approved by the Architect.

Unless otherwise agreed between the Owner and Contractor, the Contractor shall submit his requests for payment to the Architect not later than the first day of each month.

The Owner will make a partial payment to the Contractor based on Contractor's requests duly certified and approved by the Architect by the last day of the same month.

Until Substantial Completion, the Owner will pay ninety percent (90%) of the amount due the Contractor on account of progress payments. If the manner of completion of the Work and its progress are and remain satisfactory to the Owner, and in absence of other good and sufficient reasons, when the Project is indicated 50 percent or more complete (Work in Place, not including stored materials) in the application for Payment, the Contractor may, without reduction of previous retainage, request that any remaining progress payments be paid in full. This request shall be in writing and is subject to the Architect's recommendation and Owner's written approval.

The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Owner or for other good and sufficient reasons.

No further reduction in retainage will be made upon Substantial Completion of the Work."
Add the following to Subparagraph 9.3.2:

"In requesting payment for materials stored on or off the site, the Contractor shall submit with his Application for Payment the following or any other information required by the Owner:

An itemized list of the stored material prepared in sufficient detail to identify the materials and their value.

Evidence such as bills of sale or such other proof as may be requested by the Owner or Architect to substantiate that the materials listed have been paid for by the Contractor, or the materials stored at the site only, a notarized statement from the materials supplier stating that the materials will become the property of the Owner upon payment by the Owner to the Contractor.

For material stored off the site, the Contractor shall submit with his Application for Payment the following:

Evidence that the materials are stored at the location previously agreed to in writing.

Evidence that the storage location is bonded.

Evidence that the materials are insured while in storage and while in transit to the site.

Evidence that transportation to the site will be provided.

No payment will be certified for material stored off the site until:

The storage location has been agreed upon in writing.

The materials may be reviewed in their storage location by the Architect. This inspection, if performed, is an extra service for which the Owner shall pay the Architect and for which the Owner shall be reimbursed by the Contractor."

9.6 Progress Payments

Add the following Sub-Subparagraph 9.6.2.1 to Subparagraph 9.6.2:

"9.6.2.1 The Contractor shall indemnify and hold the Owner harmless from laborer's, mechanic's and materialmen's liens upon the Owner's properties or the premises upon which the work is located, arising out of the work performed or materials furnished by the Contractor or any of his subcontractors or any material suppliers under the Contract."

9.8 Substantial Completion

Add the following to Subparagraph 9.8.2

"When the Contractor considers that Work substantially complete, he shall submit a written notice to the Architect that the work, or designated portion thereof, is substantially complete along with a written list of items, if any, to be completed or corrected.

Within a reasonable time after receipt of such notice, the Architect will make a review to determine the status of completion. Should the Architect determine that the work is not substantially complete, the Architect will promptly notify the Contractor in writing giving the reasons. The Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Architect. The Architect will then review the work.

When the Architect concurs that the work is substantially complete, he will prepare a Certificate of Substantial Completion on AIA Form G704-2000, accompanied by the Contractor's list of items to be completed or corrected, as verified and amended by the Architect. The Architect will then submit the Certificate to the Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

When the Contractor considers the work to be complete he shall submit written certification that the Contract Documents have been reviewed, the work has been inspected for compliance with the Contract Documents, work has been completed in accordance with the Contract Documents, equipment and systems have been tested in the presence of the Owner's representative and are operational, and work is completed and ready for final inspection.

Should the Architect consider the work to be incomplete or defective, the Architect will promptly notify the Contractor in writing, listing the incomplete or defective work. The Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the

Architect that the work is complete. The Architect will review the work. When the Architect finds the work to be acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

Should the Architect perform reviews due to failure of the work to comply with the claims of status of completion made by the Contractor, the Owner shall compensate the Architect for such additional services. The Owner will deduct the amount of such compensation from the final payment to the Contractor. The Contractor shall submit closeout submittals to the Architect in accordance with Section 01700 - Project Closeout."

9.10 Final Completion and Final Payment

Add the following to Subparagraph 9.10.2:

"At the completion of the project prior to receiving final payment, the Contractor shall furnish the Owner, through the Architect, properly signed and notarized waivers of lien from all subcontractors employed and material suppliers furnishing materials for the Project. Such waivers shall be submitted before final payment will be certified by the Architect to the Owner. The final inspection by DHSR and the Architect are on e time occurrence for each respective phase. If the Project does not pass final inspection due to no fault of the Owner or Architect, the Contractor shall pay the Owner for expenses incurred as a result of a return by DHSR and the Architect for final inspections."

Article 11 – Insurance and Bonds

11.1 Contractor's Liability Insurance

Add the following Sub-Subparagraph 11.1.2.1 to Subparagraph 11.1.2:

"11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law.

1. Worker's Compensation:
   (a) State — Statutory
   (b) Employer's Liability — $1,000,000

2. Comprehensive General Liability (including Premises-Operations; Independent Contractor's Protective; Products and Completed Operations; Bodily Injury; Broad Form Property Damage). The Contractor shall include the Architect as an additional insured party on the Comprehensive General Liability Policy.

   (a) Combined single interest (bodily injury and property damage): minimum. — $1,000,000

   (b) Property Damage Liability Insurance shall provide X, C, and U coverage.

3. Contractural Liability:

   Combined single interest: $1,000,000 minimum.

4. Personal injury, with Employment Exclusion deleted:

$1,000,000 Annual Aggregate

5. Comprehensive Automobile Liability (including hired and non-owned coverage):

Combined single interest: $1,000,000

6. Business Umbrella Policy: $1,000,000

Add the following Sub-Subparagraph 11.1.3.1 to Subparagraph 11.1.3:

"11.1.3.1 The Contractor shall furnish one copy each of Certificates of Insurance herein required for each copy of the Agreement which shall specifically set forth evidence of all coverage required by Subparagraph 11.1.1, 11.1.2 and 11.1.3. The form of the Certificates shall be AIA Document G-715-1991. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

11.4 Performance Bond and Payment Bond

Add the following to Subparagraph 11.4.1:

"Form of Performance Bond and Labor and Material Payment Bond shall be AIA Document A312. Performance Bond will be required for 100% of the Contract Work. Labor and Material Bond will be 100% of the Contract work. Bond shall be written indentifying the Owner and this Project as its obligation (Dual Obligee)."

Article 13 - Miscellaneous Provisions:

13.1 Governing Law

Add the following to Subparagraph 13.1.1:

"In all operations under the Contract, the Contractor agrees that he will comply with provisions of all State and Federal Laws (including OSHA) and all local ordinances which may affect such operations."

13.3 Written Notice

Add the following to Subparagraph 13.3.1:

"Any papers delivered to, or notice to or demand upon Owner shall be sufficiently given if delivered to _____.

Article 15 Claims and Disputes:

Add the following to Subparagraph 15.1.2 :

"Claims must be made by written notice. Any claim implemented by Change Order shall represent the entire claim for that event and no additional claims shall be made by either party to the Contract after the claim has been implemented by Change Order."

END OF SECTION

SECTION 006010 – AFFIDAVIT OF PRIME CONTRACTOR

AFFIDAVIT OF PRIME CONTRACTOR

(STATUS OF SUBCONTRACTORS AND MATERIAL SUPPLIERS)

Date:

We, _____, certify that to the best of our knowledge and belief, no claims or liens exist against any material suppliers or subcontractors who furnished materials or labor on the NOVANT HEALTH FAMILY MEDICAL CLINIC – GREENFIELD ST., or if any appear afterwards, we (as Contractor) shall save the Owner harmless on account thereof. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable Attorney's fee.

Sworn to and subscribed before me this _____ day of _____ , 20_____.

By: _____

Title: _____

Date: _____

Notary Public: _____

Date: _____

END OF SECTION

SECTION 006020 – RELEASE AND WAIVER OF CLAIM

RELEASE AND WAIVER OF CLAIM

PRIME CONTRACTOR

On _____ , 20 _____ there personally appeared before me the undersigned authority in and for said County and State of _____ (County), _____ (State), _____ (Name), _____ (Title), of _____ (Company),

Who being duly sworn by me, states that all payrolls, materials bills, sales tax, privilege tax or license, old age benefits tax, state and federal unemployment insurance and other liabilities have been paid in full, incurred for use in the performance of the contract for the NOVANT HEALTH FAMILY MEDICAL CLINIC – GREENFIELD ST. and waives any claims and releases NOVANT HEALTH, from any rights or claims for debts due and owing by virtue of the furnishing of any material or supplies of any lien thereon.

Sworn to and subscribed before me this _____ day of _____ , 20_____.

_____
(Signature)

By: _____

Title: _____

Date: _____

_____ SEAL:
(Notary Public)

SECTION 006030 – ASBESTOS-FREE WARRANTY

ASBESTOS-FREE WARRANTY

NOVANT HEALTH FAMILY MEDICAL CLINIC – GREENFIELD ST.
WILMINGTON, NC

The undersigned Contractor hereby warrants that no asbestos-containing materials of any kind were used in the construction of the NOVANT HEALTH FAMILY MEDICAL CLINIC.

Signed: _____

Name: _____

Title: _____

(Corporate Seal)

Subscribed and sworn before me this

_____ day of _____ , 20_____.

_____
(Notary Public)

SECTION 006040 – CONTRACTOR'S GENERAL WARRANTY

CONTRACTOR'S GENERAL WARRANTY

NOVANT HEALTH FAMILY MEDICAL CLINIC – GREENFIELD ST.
WILMINGTON, NC

The undersigned Contractor hereby warrants, in accordance with the applicable provisions and terms set forth in the Contract Documents, al materials and workmanship incorporated in the NOVANT HEALTH FAMILY MEDICAL CLINIC – GREENFIELD ST. against any and all defects due to faulty materials or workmanship or negligence for a period of 12 months, or such longer periods as set forth in the Contract Documents, from the effective date of this warranty. This contractor further warrants al work incorporated in this project to remain leak-proof and watertight at all points for a period of 24 months from the effective date of this Warranty.

This Warranty shall be binding where defects occur due to normal usage conditions and does not cover willful or malicious damage, damages caused by acts of God or other casualty beyond the control of the Contractor.

This Warranty shall be in addition to other warranties and guarantees set forth in the Contract Documents, and shall not act to constitute a waiver of additional protection of the Owner afforded, where applicable, by consumer protection and product liability provisions of law, and these stipulations shall not constitute waiver of any additional rights or remedies available to the Owner under the law.

Signed: _____

Name: _____

Title: _____

Date: _____

(Corporate Seal)

Subscribed and sworn before me this

_____ day of _____ , 20 _____.

_____ (Notary Public)

SECTION 006050 – SUBMITTAL DATA FORM

SUBMITTAL DATA FORM

NAME OF PROJECT: **Novant Health Family Medical Clinic – Greenfield St.**

OWNER: **Novant Health**
3600 Country Club Drive
Winston-Salem, NC 27104

ARCHITECT: **Neighboring Concepts**
1635 West Trade Street, Suite 1A
Charlotte, NC 28216

CONTRACTOR:

SUBCONTRACTOR:

SUPPLIER:

SPECIFICATION DIVISION. NO.:

SPECIFICATION PARAGRAPH. NO.:

DRAWING REFERENCE / DETAIL:

MANUFACTURER:

CONTRACTOR'S APPROVAL STAMP:

SECTION 006060 – REQUEST FOR SUBSTITUTIONS

REQUEST FOR SUBSTITUTION

TO: Neighboring Concepts
1635 West Trade Street, Suite 1A
Charlotte, NC 28216
(704) 374-0916

FROM: _____
Name of Company

_____
Street Address

_____
City and State

_____
Phone Number and Name of Person to Contact

PROJECT:

1. Specification Section and Paragraph numbers of product specified: _____

2. Proposed Substitution

a. Name and Model No. _____

b. Manufacturer:

Name: _____

Address: _____

Phone: _____

c. Description: _____

_____

_____

d. Attach applicable performance and test data.

e. Numbers of applicable reference standards. _____

f. Attach a color chart, if applicable.

g. Attach installation instruction.

3. Manufacturer's Reputation: Attach the following:

a. Evidence of reputation for prompt delivery.

b. Evidence of reputation for efficiency in servicing products.

4. Comparison: Attach an itemized comparison of the proposed substitution with product specified.

5. Previous Installation: Provide the following information on similar projects on which proposed substitution was used, list only installation of the project within 150 mile radius.

	Name and Address of project	Date of Installation	Name, Address & Phone number of Architect
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____
d.	_____	_____	_____

6. Changes in work: Attach date relating to changes required in other work to permit use of proposed substitution and changes required in the construction schedule.

7. Cost Data: Attach accurate cost data on proposed substitution in comparison with product specified including work identified in 6 above.

8. In making formal request for substitution, Contractor represents:

a. He has investigated proposed product and has determined it is equal to or superior to specified product.

b. He will provide same or superior warranties and bonds for substitution as for specified product.

c. He certifies cost data presented is complete and includes all related costs under this Contract but excludes any Architect's redesign costs, and waives all claims for additional cost related to substitution which subsequently becomes apparent; and

d. He will coordinate installation of accepted substitute, making such changes as may be required for Work to be complete in all respects.

e. He waives claims for additional costs caused by substitution which may subsequently become apparent.

Signature of Subcontractor or Material Mfg. Date

Signature of Contractor Date

SECTION 006070 – WARRANTEES AND BONDS

WARRANTIES AND BONDS

PART 1-GENERAL

SECTION INCLUDES:

General requirements.
Warranty requirements.
Preparation and submittal.
Time of submittals.

RELATED SECTIONS:

Section 000130 – Supplier Diversity in Construction Statement
Section 005210 – General Conditions (AIA Document A201-2017): Performance Bond, Labor and Material Payment Bonds, Warranty, and Correction of Work.
Individual Specifications Sections: Warranties required for specific products or Work.

GENERAL REQUIREMENTS:

This section specifies general requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials. Specific requirements for warranties for the Work and products and installation that are specified to be warranted are included in the individual Sections of Division 3 through 26. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

Disclaimers and Limitations: Manufacturer'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, manufacturer's, the subcontractors required to countersign special warranties with the Contractor.

WARRANTIES REQUIREMENTS:

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.

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 with an equitable adjustment for depreciation.

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 benefitted from use of the work through a portion of its anticipated useful service life.

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.

Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

FORM OF SUBMITTALS:

Bind in commercial quality, 8-1/2 x 11 inch three-ring side binders with hardback, cleanable, plastic covers.

Label cover of each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible principal.

Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.

Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing.
Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

PREPARATION OF SUBMITTALS:

Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item or work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.

Verify that documents are in proper form, contain full information, and are notarized.
Co-execute submittals when required.
Retain warranties and bonds until time specified for submittal.

TIME OF SUBMITTALS:

For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

For items of Work when acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

TIME OF WARRANTIES:

Unless otherwise noted, warranties shall be for a period of one (1) year after final acceptance.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS and REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Novant Health Family Medical Clinic – Greenfield St.

B. Consultant Identification: The Contract Documents, Drawings dated 08-12-2022, and Project Manual dated 08-31-2022 were prepared for the project by Neighboring Concepts.

C. The work consists of:

1. Existing Conditions:
    a. There is an existing site without any building structures.

2. Demolition:
    a. No building demolition

3. New Construction
    a. The construction of the following:
        1) New 1 story office building
        2) Site/Civil utilities
        3) Landscape

D. Contractor shall furnish all material, labor, tools, supplies, equipment, transportation, superintendence, temporary construction of every nature, insurance, taxes, contributions and all services and facilities, unless specifically excepted, and install all materials, items and equipment required to complete the construction of the Project, as set forth in the Contract Documents and as required to provide complete and operational systems.

E. The Contractor shall act as the Project Expediter and be responsible for coordinating the work and schedules of others hired by him.

1.3 CONTRACT

A. Project will be constructed as a Single Prime.

1.4 WORK SEQUENCE

A. The Work shall be conducted in (1) phase.

1.5 WORK UNDER OTHER CONTRACTS

A. Separate Contract: Owner reserves the right to award a separate contract for performance of certain construction operations at Project site. Those operations may be conducted simultaneously with Work under this Contract. Separate Work may include but is not limited to:
   1. Hazardous Materials Abatement Contract
   2. Telecommunications Contract
   3. Staff Relocation Contract
   4. Furniture Selection Contract

B. Contractor shall cooperate fully with separate contractors so work on other contracts may be carried out smoothly, without interfering with or delaying Work under this Contract.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Technical Specifications Format: The Specifications are organized into Divisions and Sections using the 48-division format and Construction Specifications Institute / Construction Specifications Canada (CSI/CSC's) 2004 "Master Format" numbering system.

   1. Section Identification: The Technical Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

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

   1. Abbreviated Language: Language used in the Technical Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Technical Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS

2.1 PRODUCTS ORDERED IN ADVANCE

A. Unless otherwise stated in the Contract Documents, Costs for receiving, handling, storage if required, and installation of material and equipment shall be included in the Contract Sum.

2.2 OWNER-FURNISHED PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011100

SECTION 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS and REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Contingency allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.

2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 ACTION SUBMITTALS

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

1.5 CONTINGENCY ALLOWANCES

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of: (Percentage of overall site cost), divided as described below, for use according to Owner's written instructions.

1. Mass Rock Excavation and Replacement ..... $ _____.

2. Cutting and Patching of Concrete ..... $ _____.

3. Unsatisfactory Soil Excavation and Replacement..... $ _____.

B. Indicate Allowance breakdown on the Application for Payment, Schedule of Values.

END OF SECTION 012100

SECTION 012200 – 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.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.

2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

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

B. Unit Prices Offered by Bidder: The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work as described in Section 012200 "Unit Prices" and for adjustment of the quantity given in the Unit-Price Allowance for the actual measurement of individual items of the Work.

D. If the Unit Price does not affect the Work of this contract, the Bidder shall indicated “Not Applicable.”

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, 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.

E. Any unsuitable soil payment is required to have backup documentation as provided by the Owner-retained field geotechnical engineer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES OFFERED BY CONTRACTOR

A. Unit Price No. UP-1: Mass rock excavation and replacement with satisfactory soil material.

1. Description: Classified mass rock excavation and disposal off-site and replacement with engineered fill from off-site, as required, according to Section 003132 "Geotechnical Data".

2. Unit of Measurement: Cubic yard of rock excavated, based on survey of volume after removal.

3. Contractor to provide unit price per cubic yard.

B. Unit Price No. UP-2: Cutting and patching of concrete slabs-on-grade.

1. Description: Cutting of new or existing concrete slabs-on-grade up to 6 inches thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete in accordance with Section 017300 “Execution,” not otherwise indicated in the Contract Documents.

2. Unit of Measurement: Square feet of concrete removed and patched.

3. Contractor to provide unit price per square foot.

C. Unit Price No. UP-3: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Classified unsatisfactory soil excavation and disposal off-site and replacement with engineered fill from off-site, as required, according to Section 003132 "Geotechnical Data".

2. Unit of Measurement: Cubic yard of soil excavated, based on surveys of volume after removal.

3. Contractor to provide the following unit price per cubic yard.

a. Unit Price No. UP-3.1: Materials removed and displaced on-site.

c. Unit Price No. UP-3.2: Materials removed and disposed of off-site.

d. Unit Price No. UP-3.3: Fill material mined from on-site area.

e. Unit Price No. UP-3.4: Fill material imported from off-site location.

END OF SECTION 012200

SECTION 012500 - SUBSTITUTION PROCEDURES

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

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

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Cost information, including a proposal of change, if any, in the Contract Sum.
f. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution.

Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications whereas all parties agree to the following:

1. A modification in the Work or Contract Documents.

2. The amount of the adjustment in the Contract Sum, if any.

3. The extent of the adjustment in the Contract Time, if any.

1.3 NOTIFICATION TO SURETY

A. The Contractor shall notify the Surety of any modifications to the Work or provisions of the Contract Documents, including, but not limited to, the Contract Price or Contract Time.

1.4 MINOR CHANGES IN THE WORK

A. The Consultant shall have authority to order Minor Changes in the Work not involving adjustment to the Contract Sum or extension of the Contract Time, and consistent with the intent of the Contract Documents. Such changes shall be in a form of a written order and shall be binding for both the Owner and Contractor when fully executed.

1.5 CLAIMS FOR ADDITIONAL COST:

No claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with the following:

Notice: **Written notice stating the general nature of each claim shall be delivered by the claimant to the other party to the Contract promptly, but in no event later than thirty (30) days after the start of the event giving rise to the claim**.

The responsibility to substantiate a claim shall rest with the party making the claim. The amount or extent of the claim, with supporting data, shall be delivered to the other party to the Contract within fifteen (15) days after the initial Notice of the Claim. Each claim shall be accompanied by claimant's written statement that the adjustment

claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to the claimant within thirty (30) days after receipt of the claimant's last submittal. Prior notice is not required for Claims relating to an emergency endangering life or property.

The Contractor shall submit a claim if he believes additional cost is involved for reasons including but not limited to the following:

1. A written interpretation from the Consultant,

2. An order by the Owner to stop the Work where the Contractor was not at fault,

3. A written order for a minor change in the Work issued by the Consultant,

4. A change in the Scope of the Work by the Consultant.

1.6 PROPOSAL REQUESTS

The Owner initiated Proposal Requests is generated by the Owner to modify the Work or Contract Documents. The Consultant will issue a detailed description of proposed modifications in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. The description is for information and shall be considered as a directive to automatically stop work or execute the proposed change.

1. Within ten 10-calendar days after receipt of the Proposal Request, the Contractor shall submit a Proposal Request Form with an estimate to adjust the Contract Sum and the Contract Time if necessary to execute the change. Proposal shall include support documents from Subcontractor, if applicable.

    a. Include a list of quantities of (plus or minus) the materials and/or products required with unit prices, total amount of purchases, and credits to be made. If requested, furnish survey data to substantiate quantities.

    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

    c. Include costs of labor and supervision directly attributable to the change, including social security, old age and unemployment insurance, fringe benefits, and workmen’s compensation insurance.

    d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start, and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. In order to facilitate the review of quotations, all proposals shall be accompanied by a complete itemization of costs, including labor, materials and subcontracts. Labor and materials shall be itemized in the manner described above. Where major cost items are subcontracts, they shall be itemized also, submitted in the same form under the Subcontractor's letterhead. Under no circumstance will a change involving more than one hundred dollars ($100) be approved without such itemization.

2. The Contractor may initiate proposals if latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Consultant.

a. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

b. Include a list of quantities of (plus or minus) the materials and/or products required with unit prices, total amount of purchases, and credits to be made. If requested, furnish survey data to substantiate quantities.

c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

d. Include costs of labor and supervision directly attributable to the change, including social security, old age and unemployment insurance, fringe benefits, and workmen's compensation insurance.

e. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

f. Comply with requirements in Division 1 Section, of the Technical Specifications "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

g. In order to facilitate the review of quotations, all proposals shall be accompanied by a complete itemization of costs, including labor, materials and subcontracts. Labor and materials shall be itemized in the manner described above. Where major cost items are subcontracts, they shall be itemized also, submitted in the same form under the Subcontractor's letterhead. Under no circumstance will a change involving more than one hundred dollars ($100) be approved without such itemization.

An alternative method to price the changes in the work is to utilize current "RS Mean's Cost Data" for the current yearly quarter.

Profit and Overhead shall not exceed ten percent (10%) on net increase of labor and material for work performed by the Contactor's own forces and five percent (5%) on net increase of subcontractor's work. Bonuses; sick leave; vacation and holiday pay; bookkeeping, clerical, estimating, superintendence, project management or other items of indirect costs or overhead, shall be compensated for by the overhead and profit percentages listed herein.

For the Contractor, or Work performed by the Contractor's own forces, ten percent (10%) of the cost.
For the Contractor, or Work performed by the Contractor's Subcontractor, five percent (5%) of the cost.
For each Subcontractor's Work performed by the Subcontractor's own forces, ten percent (10%) of the cost.
For each Subcontractor, for Work performed by the Subcontractor's Subcontractors, five percent (5%) of the amount due the Sub-subcontractor shall be added as the allowance for overhead and profit.

Use Proposal Request Form provided by Owner. A Sample is included under Project Manual Heading VII - Forms. The Contractor shall prepare three copies, one for the Consultant, one for the Owner and one for himself and for all parties to sign. Each shall keep a copy.

The Contractor shall be responsible for keeping and updating a "Proposal Request Log", listing all Proposal Requests and Minor Changes. The log shall also indicate the date of the Proposal Request, approval date, action taken, running balances, and a complete description of the change.

After all parties have signed "The Proposal Request Form", it shall be the Contractor's authorization to proceed with the changes to the Work.

If the Owner and Contractor do not agree with the requested adjustment in the Contract Sum, the Contract Time or the method of determining each, the provisions for Mediation shall be utilized.

1.8 CHANGE ORDER PROCEDURES

A. The Consultant shall issue a Change Order for signatures once all of the Proposal Request(s) amounts exceeds the contingency amount or at the end of the project.

B. The Contractor shall not invoice for the Change Order until it has been executed by all parties.

1.9 CONSTRUCTION CHANGE DIRECTIVE

A. The Consultant may issue a Construction Change Directive that has been signed by the Owner to the Contractor directing a change in the Work. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

C. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved. And the Contractor shall advise the Consultant 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.

D. The Contractor shall maintain detailed records on a time and material basis of work required by the Construction Change Directive.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROCESSING CHANGE ORDERS

A. The Change Order will be issued describing the change or changes to the Work and/or Contract Documents and will refer to the Proposal Requests.

B. The Consultant shall issue one copy of the Change Order to the Contractor. The Contractor shall promptly sign the copy and return the copy to the Consultant who will sign the Change Order and forward the Change Order to the Owner to execute.

C. Once the Change Order has been full executed, a copy shall be forwarded to the Consultant and to the Contractor for their files.

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1, of the Technical Specifications Section "Allowances" for procedural requirements governing handling and processing of allowances.
   2. Division 1, of the Technical Specifications Section "Unit Prices" for administrative requirements governing use of unit prices.
   3. Division 1, of the Technical Specifications Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   4. Division 1, of the Technical Specifications Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms AIA G702.
      b. Continuation Sheets (example of the Continuation Sheet form is in the Project Manual Heading VII Forms).

   2. Submit the Schedule of Values to the Consultant at earliest possible date but no later than fourteen days before the date scheduled for submittal of initial Applications for Payment.

3. Sub-schedules: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. 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 of the Technical Specifications Section and line item for potential billing against the Construction Contingency Allowance.

1. Identification: Include the following Project information on the Schedule of Values:
   a. Project name and location.
   b. Name of Consultant.
   c. Contract number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Technical Specifications Section or Division.
   b. Description of the Work.
   c. Name of subcontractors.
   d. Name of manufacturer or fabricator.
   e. Name of suppliers.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.

3. Group items that are “Non-Tangible & Non-Taxable and Tangible & Taxable Items” on the Schedule of Values (see VII. Forms, Continuation Sheet).

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

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include labor and materials and/or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Closeout documentation: Provide a separate line item in the Schedule of Values for close out documentation as set forth in the Supplementary Conditions.

9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

10. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

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

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

2. Contractor **Coordination Drawings** are required within 60 calendar days of the issued Notice-to-Proceed. Failure to provide requirements shall result in delays of the Initial Application for Payment.

B. Such applications shall 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.

C. 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 material 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 material and equipment or otherwise protect the Owner’s interest, and shall include applicable insurance, storage and transportation to the site for such material and equipment stored off the site.

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

D. Payment Application Times: Each Month, the County can make a partial payment to the Contractor on the basis of a duly notarized Application and Certification for Payment approved and certified by the Consultant.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. The Consultant 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 of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

3. The County shall retain five (5%) percent of each payment to up fifty (50%) percent completion of the Contract.

    a. The Owner shall not retain more than five percent (5%) of any periodic payment due a prime Contractor.

    b. When the project is fifty percent (50%) complete, the Owner, with written consent of the surety, **shall not retain any further** retainage from periodic payments due the Contractor if the Contractor continues to perform satisfactorily and any nonconforming work identified in writing prior to that time by the Consultant or Owner has been corrected by the Contractor and accepted by the Consultant and Owner. If the Consultant determines the Contractor's performance is unsatisfactory, the Owner may reinstate retainage for each subsequent periodic payment application as authorized in this subsection up to the maximum amount of five percent (5%). The project shall be deemed fifty percent (50%) complete when the Contractor's gross project invoices, excluding the value of materials stored off-site, equal or exceed fifty percent (50%) of the value of the contract, except the value of materials stored on-site shall not exceed twenty percent (20%) of the Contractor's gross project invoices for the purpose of determining whether the project is fifty percent (50%) complete.

    c. Within 60 days after the submission of a pay request and one of the following occurs, as specified in the contract documents, the Owner with written consent of the surety shall release to the Contractor all retainage on payments held by the Owner:

        1) The Owner receives a certificate of substantial completion from the Consultant in charge of the project; or (ii) the Owner receives beneficial occupancy or use of the project. However, the Owner may retain sufficient funds to secure completion of the project or corrections on any work. If the Owner retains funds, the amount retained shall not exceed two and one-half times the estimated value of the work to be completed or

corrected. Any reduction in the amount of the retainage on payments shall be with the consent of the Contractor's surety.

d. The existence of any third-party claims against the Contractor or any additive change orders to the construction contract shall not be a basis for delaying the release of any retainage on payments.

1) Full payment, less authorized deductions, shall also be made for those trades that have reached one hundred percent (100%) completion of their contract by or before the project is fifty percent (50%) complete if the Contractor has performed satisfactorily. However, payment to the early finishing trades is contingent upon the Owner's receipt of an approval or certification from the Consultant of record or applicable engineer that the work performed by the subcontractor is acceptable and in accordance with the contract documents. At that time, the Owner shall reduce the retainage for such trades to **five-tenths percent (0.5%)** of the contract. Payments under this subsection shall be made no later than 60 days following receipt of the subcontractor's request or immediately upon receipt of the surety's consent, whichever occurs later. Early finishing trades under this subsection shall include structural steel, piling, caisson, and demolition. The early finishing trades for which line-item release of retained funds is required shall not be construed to prevent an Owner or an Owner's representative from identifying any other trades not listed in this subsection that are also allowed line-item release of retained funds. Should the Owner or Owner's representative identify any other trades to be afforded line-item release of retainage, the trade shall be listed in the original bid documents. Each bid document shall list the inspections required by the Owner before accepting the work, and any financial information required by the Owner to release payment to the trades, except the failure of the bid documents to contain this information shall not obligate the Owner to release the retainage if it has not received the required certification from the Consultant of record or applicable engineer.

2) Notwithstanding 3-a & b of this section, following fifty percent (50%) completion of the project, the Owner shall be authorized to withhold additional retainage from a subsequent periodic payment, not to exceed five percent (5%) as set forth in 3-a of this section, in order to allow the Owner to retain two and one-half percent (2.5%) total retainage through the completion of the project. In the event that the Owner elects to withhold additional retainage on any periodic payment subsequent to release of retainage pursuant to 3-d-i of this section, the General Contractor may also withhold from the subcontractors remaining on the project sufficient retainage to offset the additional retainage held by the Owner, notwithstanding the actual percentage of retainage withheld by the Owner of the project as a whole.

3) Neither the Owner's nor Contractor's release of retainage on payments as part of a payment in full on a line-item of work under 3-d-i of this section

shall affect any applicable warranties on work done by the Contractor or subcontractor, and the warranties shall not begin to run any earlier than either the Owner's receipt of a certificate of substantial completion from the Consultant in charge of the project or the Owner receives beneficial occupancy.

e. Nothing in this section shall prevent the prime Contractor at the time of application and certification to the Owner from withholding application and certification to the Owner for payment to the subcontractor for unsatisfactory job progress; defective construction not remedied; disputed work; third party claims filed or reasonable evidence that claim will be filed; failure of subcontractor to make timely payments for labor, equipment, and materials; damage to prime Contractor or another subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by the Owner.

f. Nothing in this section shall prevent the Owner from withholding payment to the Contractor in addition to the amounts authorized by this section for unsatisfactory job progress, defective construction not remedied, disputed work, or third-party claims filed against the Owner or reasonable evidence that a third-party claim will be filed.

4. Provide a separate line item in the Schedule of values for close out documentation as set forth in the Supplementary Conditions.

F. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to the Consultant.

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

G. With each Application and Certification for payment, the Contractor must furnish for themselves, as well as for all Subcontractors**,** certified statements stating the cost of the property purchased from each vendor and the amount of sales and/or use taxes paid. See General Conditions, Sales and Use Tax for additional information**.**

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

I. Neither Final payment nor any remaining retained percentage shall become due until the Contractor submits the following to the Consultant for approval:

1. An affidavit that payrolls, bills for material and other indebtedness connected with the Work has been paid or otherwise satisfied,

2. A certificate evidencing that insurance required by the Contract Document to remain in force after Final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner,

3. Consent of surety to Final payment and

4. If required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of claim 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 the 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 claim of lien. If such claim of lien 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 such claim, including all costs and reasonable attorneys' fees.

5. MWSBE form VI.

6. A list of all suppliers and subcontractors that were involved with the project. As part of the list, the Contractor shall include the address, phone number, what they supplied or Work performed, and a contact name.

7. "As-Builts" Drawings and all other specified closeout documents.

8. Maintenance and Operation instructions and guarantees.

J. Final Payment Application: Submit three originals with the final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Warranties and Test results required by the Contract Documents.

2. Updated final statement, accounting for final changes to the Contract Sum.

3. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

4. AIA Document G706A, "Contractor's Affidavit of Release of Liens."

5. AIA Document G707, "Consent of Surety to Final Payment."

6. Additional Evidence that claims have been settled if required by the Owner. An example of the evidence could be a letter from a subcontractor indicating that he has been paid in full for the work that he has performed.

7. Certificates from all local and State Governing Agencies as required by Law.

8. Final liquidated damages settlement statement.

9. List of Subcontractors and Suppliers that has contributed to the completion of the Work. The list shall include:

    a. Material they supplied or type of construction they performed.

    b. Address

    c. Contact person

    d. Phone number

10. M/WSBE From VI

11. Final Sales Tax Form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Consultant will chair and conduct project meetings and compile an agenda for each meeting throughout the construction period.

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

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Project meetings.

C. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 1, of the Technical Specifications Section "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
2. Division 1, of the Technical Specifications Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 1, of the Technical Specifications Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Technical 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.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, the Consultant shall prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

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

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

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. 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.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 SUBMITTALS

A. Coordination Drawings: Deleted from project scope.

B. Staff Names: Fourteen days prior to the Pre-Construction conference, submit a list of principal staff 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 and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Failure to do so may delay processing of the Initial Application for Payment.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.6 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
2. Agenda: The Consultant shall prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes:
   a. The Consultant will compile minutes of each project meeting, and will distribute copies to the Contractor and required copies to the Owner.
   b. Recipients of copies may make and distribute such other copies as they wish.

4. Attendance:
   a. To the maximum extent practical, assign the same person or persons to represent the Contractor at the project meetings throughout progress of the Work.
   b. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

5. Minimum agenda:
   a. Review, revise as necessary, and approve minutes of previous meetings.
   b. Review progress of the Work since last meeting, including status of submittals for approval.
   c. Identify problems which impede planned progress.
   d. Develop corrective measures and procedures to regain planned schedule.
   e. Complete other current business.

B. Pre-construction Conference: Schedule a pre-construction conference before starting construction, at a time convenient to Owner and Consultant, but no later than 14 days after execution of the Construction Contract. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Consultant, and their consultants; Contractor and its superintendent; major subcontractors and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

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

   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing.
   d. Designation of responsible personnel.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for processing Applications for Payment.

g. Distribution of the Contract Documents.
h. Submittal procedures.
i. Preparation of Record Documents.
j. Use of the premises.
k. Responsibility for temporary facilities and controls.
l. Parking availability.
m. Office, work, and storage areas.
n. Equipment deliveries and priorities.
o. Security.
p. Working hours.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Consultant of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related Change Orders.
d. Purchases.
e. Deliveries.
f. Submittals.
g. Review of mockups.
h. Possible conflicts.
i. Time schedules.
j. Weather limitations.
k. Manufacturer's written recommendations.
l. Temporary facilities and controls.
m. Space and access limitations.
n. Regulations of authorities having jurisdiction.
o. Testing and inspecting requirements.
p. Required performance results.
q. Protection of construction and personnel.

Record significant conference discussions, agreements, and disagreements.
Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Progress Meetings: Conduct progress meetings at a minimum of once every two weeks. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: Representatives at the meeting shall be the Owner, Consultant, Subcontractors, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Access.
        6) Work hours.
        7) Hazards and risks.
        8) Review of Record Drawings
        9) Review of construction defects that has been identified by the Consultant

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

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

1.7 REQUESTS FOR INTERPRETATION (RFI’s)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFI’s shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned 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 interpretation and the following:

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

C. RFI Format: Contractor’s standard form, submitted as hard-copy or PDF electronic submittal.

D. Standard Form

1. Identify each page of attachments with the RFI number and sequential page number.

E. Consultant’s Action: Consultant will review each RFI, determine action required, and return it. Allow seven (7) working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of substitutions.
    b. Requests for coordination information already indicated in the Contract Documents.
    c. Requests for adjustments in the Contract Time or the Contract Sum.
    d. Requests for interpretation of Consultant's actions on submittals.
    e. Incomplete RFIs or RFIs with numerous errors.

Consultant’s action may include a request for additional information, in which case Architect's time for response will start again.

1. Consultant’s action on RFI’s that may result in a change to the Contract Time or the Contract Sum does not constitute an approval to proceed with the additional Work. Contractor must submit a Change Proposal and receive written approval to proceed according to Division 1 Section "Contract Modification Procedures".
    a. If Contractor believes the RFI response warrants a change in the Contract Time or the Contract Sum, notify Consultant in writing within five (5) days of receipt of the RFI response.

F. On receipt of Consultant'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.

G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log biweekly. Include the following:

1. Project Name
2. Name and address of Contractor.
3. Name and address of Consultant.
4. RFI number including RFI's that were dropped and not submitted.
5. RFI description
6. Date the RFI was submitted.
7. Date Consultant's response was received.
8. Identification of the related Minor Change in the Work, Construction Change Directive and Proposal Request as appropriate.
9. Identification of related Field Order, Work Change Directive and Proposal Request as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Payment Procedures" for submitting Applications for Payment.
2. Division 1, of the Technical Specifications Section "Project Management and Coordination" for submitting Coordination Drawings.
3. Division 1, of the Technical Specifications Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule and construction photographs.
4. Division 1, of the Technical Specifications Section "Photographic Documentation" for submitting periodic construction photographs.
5. Division 1, of the Technical Specifications Section "Quality Requirements" for test and inspection reports and Delegated-Design Submittals and for erecting mockups.
6. Division 1, of the Technical Specifications Section "Closeout Procedures" for submitting warranties **Project Record Documents and operation and maintenance manuals.**
7. Division 1, of the Technical Specifications Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
8. Division 1, of the Technical Specifications Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Consultant's responsive action.

B. Informational Submittals: Written information that does not require Consultant's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. The Contractor shall provide the submittals as required by the Consultant's Submittal Log and the Contract Documents.

B. General: Electronic copies of CAD Drawings of the Contract Drawings will **not** be provided by Consultant for Contractor's use in preparing submittals.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. 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. Consultant reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

    b. Submittals requiring color or finish selection:
        1) Submittals that require color or finish selections may be held until all submittals are received that require coordination of colors or finishes.
            a) Final selection of product color or finish is not intended to hold the review of the product quality requirements for conformance with the Contract Documents.

D. Submittals Schedule: Comply with requirements in Division 1, of the Technical Specifications Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities. (Submittal Log)

E. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Consultant's receipt of submittal.

1. Initial Review: Allow seven (7) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Consultant will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Consultant's consultants, Owner, or other parties is required, allow twenty one (21) days for initial review of each submittal.
3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow seven (7) days for processing each re-submittal.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

F. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Consultant.

3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Consultant.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including related specification section/number and revision number.
    i. Number and title of appropriate Technical Specifications Section.
    j. Drawing number and detail references, as appropriate.
    k. Contractor's Approval stamp as described in Section 3.1.B.
    l. Other necessary identification.

G. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless additional copies are required for final submittal, and unless Consultant observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Consultant.
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Consultant will return submittals, without review, received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Consultant on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Use on form to be defined by the Consultant.

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

K. Use for Construction: Use only final submittals with mark indicating action taken by Consultant in connection with construction.

L. No extension of the Contract Time will be authorized because of incomplete or uncoordinated submittals. In addition, not extension of the Contract Time will be authorized because of the failure of re-submittals to address comments provided in previous submittals.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit 1 digital copy of each submittal, unless otherwise indicated. Consultant will return a digitally annotated copy. Mark up and retain a hard copy version of the returned copy on site as a Project Record Document.

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

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

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operating and maintenance manuals.
    k. Compliance with recognized trade association standards.
    l. Compliance with recognized testing agency standards.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.
    o. Manufacturer’s location.

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

1. Preparation: Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams and existing conditions.

e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. 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 30 by 40 inches .
4. Number of Copies: Submit 6 blue- or black-line prints of each submittal, print will be required for operation and maintenance manuals. Consultant will retain two prints; remainder will be returned.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups. Verify the samples are true presentation of the materials to be used.
2. 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.
3. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Consultant's sample where so indicated. Attach label on unexposed side that includes the following:

   a. Generic description of Sample.
   b. Product name or name of manufacturer.
   c. Sample source.

4. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

   a. Size limitations.
   b. Compliance with recognized standards.
   c. Availability.
   d. Delivery time.

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

   a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that

show approximate limits of the variations. The consultant will return submittal with the option selected.

b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

G. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."

H. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

I. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."

J. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."

K. 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.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit digital copies of each submittal, unless otherwise indicated. Consultant will return a digitally annotated copy.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

C. Qualification Data: If requested, prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Consultants and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Compatibility Test Reports: Prepare 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 for the application.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. 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.

K. Coordinate individual Specification Sections with paragraph below by including specific model code organization in that Section. If all are same, insert name below.
Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures Operation and Maintenance Data."

L. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

M. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

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

N. Construction Photographs: Comply with requirements in Division 1 Section "Construction Progress Documentation and Photographic Documentation."

O. Material Safety Data Sheets: Submit two copies for the Consultant and the Owner and keep a copy at the job site. Post warning signs when appropriate.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Consultant.

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

3.2 CONSULTANT'S ACTION

A. General: Consultant will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Consultant will review each submittal, make marks to indicate corrections or modifications required, and return it. Consultant will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

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

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded unless a justification is also submitted.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

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

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

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

C. Related Sections include the following:
1. Division 1, of the Technical Specifications Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Division 1, of the Technical Specifications Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
3. Divisions 2 through 48, of the Technical Specifications Sections for specific test and inspection requirements.

1.3 DEFINITIONS

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

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

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.

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

1.4 SUBMITTALS

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

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

1.5 QUALITY ASSURANCE

A. 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.

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

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. 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.

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

F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

G. Mockups: Before installing portions of the Work requiring mockups as indicated in of the Technical Specifications Sections 2-16 of the Construction Documents., build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Consultant.
2. Notify Consultant seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Consultant's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
2. 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 will be adjusted by Change Order.

B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

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

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

1. Testing agency will notify Consultant and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Consultant with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and re-inspect corrected work.

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

E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services as requested by the Consultant at the Contractor's expense, including retesting and re-inspecting, for construction that revised or replaced Work, at the Contractor's expense, that failed to comply with requirements established by the Contract Documents.

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

1. In the event there is a need for the Contractor to have testing performed.

2. Notify Consultant and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
3. 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 requirements of the Contract Documents or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

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

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

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

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

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Consultant, 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 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 1, of the Technical Specifications Section "Cutting and Patching."

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

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

END OF SECTION 014000

016000 - PRODUCT REQUIREMENTS

Part 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 DEFINITIONS

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

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

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

1.4 ACTION SUBMITTALS

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

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

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

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

1. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
2. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
3. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
4. Protect stored products from damage and liquids from freezing.
5. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

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

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

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

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

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

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

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

B. Product Selection Procedures:

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

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Progress cleaning.
   4. Starting and adjusting.
   5. Protection of installed construction.
   6. Correction of the Work.

B. Related Sections include the following:
   1. Division 1, of the Technical Specifications Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   2. Division 1, of the Technical Specifications Section "Submittal Procedures" for submitting surveys.
   3. Division 1, of the Technical Specifications Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
   4. Division 1, of the Technical Specifications Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   5. Division 1, of the Technical Specifications Section “Construction Waste Management” method of disposal of construction waste.

1.3 SUBMITTALS

A. Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Consultants and owners, and other information specified.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer as required.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A licensed professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS: (NOT USED)

PART 3 - EXECUTION:

3.1 EXAMINATION

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

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility, Owner, and Consultant that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: 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 Consultant, Owner, adjacent property owners not less than **two** days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Consultant's and Owner's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Consultant. Include a detailed description of problem encountered, together with recommendations for modifications of the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Consultant promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Consultant when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
7. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
8. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
9. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Consultant. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Consultant before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations. Dispose of material in accordance to Division 1, Section “Construction Waste Management”.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
   1. Thoroughly clean surfaces and similar features before applying paint or other finishing materials.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

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

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

3.6 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

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

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Owner has established that this Project shall include proactive measures for waste management participation by all parties to the contract.

1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.

2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.

3. Waste disposal to landfills shall be minimized.

B. Definitions:

1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable material.

2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris, and trash resulting from construction operations.

3. Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.

4. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.

5. Trash: Any product or material unable to be returned, reused, recycled or salvaged.

6. Landfill: Any public or private business involved in the practice of trash disposal.

7. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.2 SUBMITTALS:

A. Project Information:
1. Contractor's Construction Waste Management Plan.

1.3 CONSTRUCTION WASTE MANAGEMENT PLAN

A. Waste Management Plan shall include the following:

1. Solid Waste Disposal and Diversion document.

    a. Identification of materials recycled.
    b. Identification of materials landfill.
    c. Identification of hazardous wastes and disposal.

2. Locations of sorting and waste storage facilities on Site Plan of project.

3. Final documentation of subcontractor/supplier waste management/recycling data.

4. Final documentation of hazardous waste disposal plan.

B. Construction Waste Management Plan Implementation:

1. The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting the Waste Management Plan.

2. The "Summary of Construction Waste/Recycling" shall be completed each month and submitted as part of Application For Payment.

    a. All materials identified in the Summary shall be reported by weight.
    b. Where weight is not applicable, Contractor shall report materials by units applicable to material recipient.
    c. Contractor shall procure receipts or other validation of waste management procedures and include them as part of the submittal.

3. The Contractor shall distribute copies of the "Summary of Construction Waste/Recycling" to the Consultant, Owner and each subcontractor involved in the plan.

4. The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at appropriate stages of the Work.

5. Separation facilities:

    a. Contractor shall define specific areas to facilitate separation of materials for recycling, salvage, re-use or return.
    b. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials.
    c. Do not mix recyclable materials.
    d. Store hazardous wastes in secure areas.

6. Hazardous wastes:

a. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:

1) Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
2) Disposal of fluorescent tubes to open containers is not permitted.
3) Unused fertilizers shall not be co-mingled with construction waste.

C. Program profits:
1. All profits from recycling of construction waste shall be granted to the Contractor.

PART 2 - PRODUCTS: (NOT USED)

PART 3 - EXECUTION: (NOT USED)

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Project As-Builts Documents.
   3. Operation and maintenance manuals.
   4. Warranties.
   5. Instruction of Owner's personnel.
   6. Final cleaning.

B. Related Sections include the following:
   1. Division 1, of the Technical Specifications Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
   2. Division 1, of the Technical Specifications Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.
   3. Division 1, of the Technical Specifications Section "Photographic Documentation" for submitting Final Completion.
   4. Division 1, of the Technical Specifications Section “Construction Waste Management” method of disposal of construction waste.
   5. Division 1, of the Technical Specifications Section "Execution Requirements" for progress cleaning of Project site.
   6. Division 1, of the Technical Specifications Section “Project Record Documents”.
   7. Division 1, of the Technical Specifications Section “Operation and Maintenance Data”.
   8. Divisions 2 through 48, of the Technical Specifications Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: The Contractor shall, before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, “As-Builts” drawings, operation and maintenance manuals, Final Completion construction photographs and photographic negatives if required, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Consultant will either proceed with inspection or notify Contractor of unfulfilled requirements. Consultant will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Consultant, that must be completed or corrected before certificate will be issued. The Consultant’s Substantial Completion list is composed by verification of the punch list submitted by the Contractor and any additional defects in the work observed by the Consultant.
   1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 1, of the Technical Specifications Section "Payment Procedures."
   2. Submit certified copy of Consultant's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Consultant. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes if required.

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

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. The Contactor shall take immediate steps to correct the stated deficiencies, and send a written notice to the Consultant, certifying the Project is complete, at which time the Consultant will re-inspect the Work. This review and additional reviews by the Consultant where the Work is not considered Substantial Completion or Final Completion will be considered an additional service from the Consultant. The Contractor will be charged for these additional services incurred by such failure including travel time, observation time, and administrative time at the Consultant's hourly rate, as well as all expenses associated with the distribution of a written notice stating the reasons for failure to reach final completion.
3. In the event the Contractor is granted Substantial Completion by the Consultant and the Contractor fails to complete and/or correct all of the items listed in the Substantial Completion within **30** calendar days of the date of Substantial Completion, the liquated damages shall start to accrue until all of the items on the Substantial Completion list are completed and/or corrected and have been approved by the Consultant.
4. If the Consultant is required to make more than two inspections for the project to achieve Substantial Completion, the Contractor shall pay for the Consultant's time and expensive.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, use the room number as indicated on the drawings and on the exterior areas include a location diagram indicating the defects.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Consultant.
    d. Name of Contractor.
    e. Page number.

1.6 PROJECT RECORD DOCUMENTS

A. The Contractor shall provide Project Record Documents, O&M, “As-Builts” Drawings, and Warrantees as indicated in Division 1, of the Technical Specifications Section Project Record Documents. Use Division 1, of the Technical Specifications Section "Project Record Documents".

1.7 OPERATION AND MAINTENANCE MANUALS

A. See Section “Operation and Maintenance Manuals” for additional Information.

1.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Consultant for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

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

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION:

3.1 FINAL CLEANING

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

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

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
        1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
    m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    n. Replace parts subject to unusual operating conditions.
    o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    q. Clean ducts, blowers, and coils if units were operated without filters during construction.
    r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Operation and Maintenance manuals for the care and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:
   1. Division 1, of the Technical Specifications Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 1, of the Technical Specifications Section “Construction Waste Management” method of disposal of construction waste.
   3. Division 1, of the Technical Specifications Section "Closeout Procedures" for submitting operation and maintenance manuals.
   4. Divisions 2 through 50, of the Technical Specifications Sections for specific operation and maintenance manual requirements for products in those Sections.

1.3 DEFINITIONS

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

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

1.4 SUBMITTALS

A. Final Submittal: Submit four copies of each manual in final form at least 15 days before final inspection. Consultant will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Consultant's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Consultant's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Operations and Maintenance Manuals shall be organized in CSI format.

B. Organization: Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

C. List of Systems and Subsystems: List systems alphabetically.

D. List of Equipment: List equipment for each system, organized alphabetically by system.

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

F. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents.

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page to Include the following information:
1. Name and address of Project.
2. Name and address of Owner.
3. Date of submittal.
4. Name, address, and telephone number of Contractor and Subcontractors.
5. Name and address of Consultant.
6. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, model number, and serial number indexed to the content of the volume, and cross-referenced to of the Technical Specifications Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with reinforced tabs for each section. Mark each tab to indicate contents.
   3. If provided with the equipment, provide a Protective Plastic Sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch, white bond paper.
   5. Drawings: Attach reinforced, punched on drawings and bind in manual with associated text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Content: In addition to requirements in this section, include operation and maintenance data required in individual specification sections including source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list & source information, maintenance service contracts, warranty and bond information, and the following information:
   1. System, subsystem, and equipment descriptions.
   2. Performance and design criteria if Contractor is delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.

6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. Re-ordering information for parts.
11. Standard printed maintenance instructions and bulletins.
12. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
13. Identification and nomenclature of parts and components.
14. List of items recommended to be stocked as spare parts.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Routine and normal operating instructions.
3. Regulation and control procedures.
4. Instructions on stopping.
5. Normal shutdown instructions.
6. Seasonal and weekend operating instructions.
7. Required sequences for electric or electronic systems.
8. Special operating instructions and procedures.

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

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

F. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

G. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Disassembly; component removal, repair, and replacement; and reassembly instructions.
4. Aligning, adjusting, and checking instructions.
5. Demonstration and training videotape, and training manual if available.
6. Inspection procedures.
7. Types of cleaning agents to be used and methods of cleaning.
8. List of cleaning agents and methods of cleaning detrimental to product.
9. Schedule for routine cleaning and maintenance.
10. Repair instructions.

H. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

I. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

J. If “Maintenance Service Contracts” are required by Contract Documents, provide copies of maintenance agreements with name and telephone number of service agent.

K. Warranties and Bonds: Include copies of warranties and bonds for each piece of equipment and lists of circumstances and conditions that would affect validity of warranties or bonds. Also, include the Contractor’s Warranty for the project.
   1. Include procedures required for notifications for warranty claims.

PART 3 - EXECUTION:

3.1 MANUAL PREPARATION

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

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

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a

tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

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

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. As-Built Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 1, of the Technical Specifications, Section "Closeout Procedures" for general closeout procedures.
   2. Division 1, of the Technical Specifications, Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 2 through 16, of the Technical Specifications, Sections for specific requirements for Project Record Documents of products in those Sections.

1.3 SUBMITTALS

A. As-Built Drawings: Comply with the following:
   1. Number of Copies: Submit two sets of marked-up As-Built Drawings to the Consultant for the Consultant to prepare the Record Drawings.

B. Record Specifications: Submit two copies of Project's marked up Specifications, including addenda and contract modifications.

C. Record Product Data: Submit two copies of each Product Data submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 AS-BUILT DRAWINGS

A. As-Built Drawings: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark As-Built Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up As-Built Drawings.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Consultant's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.
      o. Clarification Drawings.
   3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
   7. Identify and date each As-Builts Drawing; include the designation "PROJECT AS-BUILTS DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

B. Newly Prepared As-Built Drawings: Prepare new Drawings instead of preparing As-Built Drawings where Consultant determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
   1. New Drawings may be required when a Change Order is issued as a result of accepting a substitution or other modification.
   2. Consult with Consultant for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction.

Integrate newly prepared As-Built Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

2.2 RECORD SPECIFICATIONS

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

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, As-Built Drawings, and Product Data where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

PART 3 - EXECUTION:

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project

Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Consultant's reference during normal working hours.

END OF SECTION 017839

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Footings.
2. Slabs-on-grade.

B. Related Sections:
1. Division 32 for concrete pavement and walks.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Welding certificates.

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

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

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

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

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

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

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

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

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

a. 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.
b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency

laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

G. Preinstallation Conference: Conduct conference at Project site.

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

   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Special concrete finish subcontractor.
   f. Synthetic Fiber Manufacture’s representative.

2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips**,** vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
3. Review floor finishes to be installed and coordinate with curing methods to be used.
4. Review floor finish with synthetic macro fibers.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer 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. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Axim Italcementi Group, Inc.; CATEXOL CN-CI
b. BASF Construction Chemicals - Building Systems; Rheocrete CNI
c. Euclid Chemical Company (The), an RPM company; ARRMATECT, EUCON BCN, or EUCON CIA
d. Grace Construction Products, W. R. Grace & Co.; DCI
e. Sika Corporation; Sika CNI

D. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
b. FORTA Corporation; FORTA FERRO.
c. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.

d. Nycon, Inc.; XL.
e. Propex Concrete Systems Corp.; Fibermesh 650.
f. Sika Corporation; Sika Fiber MS.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Maximum perm rating of 0.02.

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. Fortifiber Building Systems Group; Moistop Ultra 15
b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120
c. Insulation Solutions, Inc.; Viper VaporCheck II
d. Meadows, W. R., Inc.; Perminator 15 mil
e. Raven Industries Inc.; Vapor Block 15
f. Reef Industries, Inc.; Griffolyn 15 mil Green
g. Stego Industries, LLC; Stego Wrap 15 mil Class A

2. Provide manufacturer's compatible sealer system for penetrations.

B. Granular Fill: Provide one of the following:

a. Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

b. Clean sands with less than 3 percent fines. Materials to be verified by a qualified Geotechnical Engineer.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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. BASF Construction Chemicals - Building Systems; Confilm
b. ChemMasters; SprayFilm
c. Conspec by Dayton Superior; Aquafilm
d. Dayton Superior Corporation; Sure Film (J-74)
e. Euclid Chemical Company (The), an RPM company; Eucobar
f. L&M Construction Chemicals, Inc.; E-CON
g. Meadows, W. R., Inc.; EVAPRE
h. Sika Corporation; SikaFilm
i. Symons by Dayton Superior; Finishing Aid
j. Unitex; PRO-FILM

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Anti-Hydro International, Inc.; AH Clear Cure WB
b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB
c. ChemMasters; Safe-Cure & Seal 20
d. Conspec by Dayton Superior; Cure and Seal WB
e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal
f. Dayton Superior Corporation; Safe Cure and Seal (J-18)
g. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150
h. L&M Construction Chemicals, Inc.; Dress & Seal WB
i. Meadows, W. R., Inc.; Vocomp-20
j. Symons by Dayton Superior; Cure & Seal 18 Percent E

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength – typical interior slab: 3000 psi at 28 days.
2. Minimum Compressive Strength – : typical exterior slab: 4000 psi at 28 days.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: For exterior broom finished concrete only; 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 3.0 lb/cu. yd..

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

B. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
1. Following leveling and tamping of granular base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
3. Lap joints 6 inches and seal with manufacturer's recommended tape.
4. Apply seam tape to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer’s instructions.
6. Avoid the use of non-permanent stakes driven through vapor retarder.
7. If non-permanent stakes are driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
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.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue

final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

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 thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.10 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.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

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 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

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

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cu. yd. of concrete, nor less than once for each 5,000 sq. ft. of surface area for slabs or walls.
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, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 042000 – UNIT MASONRY

GENERAL

1.1 SUMMARY

This Section includes the following:

1. Concrete masonry units.
2. Common Brick.
3. Mortar and grout.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

Related Sections include the following:

8. Division 05 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry

9. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, according to ASTM C 67 for compressive strength.

2. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength.
4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Cast Stone Trim Units: Show sizes, profiles, and locations of each cast stone trim unit required.
3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Common Brick
3. Colored mortar.
4. Weep holes/vents.

D. Qualification Data: For testing agency.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

G. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. 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.

C. 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.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

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. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT 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.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. 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.

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.

D. 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 ACI 530.1/ASCE 6/TMS 602.

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.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PRODUCTS

1.9 UNIT MASONRY, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.10 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sills, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.

2. Density Classification: Medium weight unless otherwise indicated.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Size (Width): Manufactured to the following dimensions:

    a. 4 inches nominal; 3 5/8 inches actual.
    b. 6 inches nominal; 5 5/8 inches actual.
    c. 8 inches nominal; 7 5/8 inches actual.
    d. 12 inches nominal; 11 5/8 inches actual.
    e. 16 inches nominal; 15 5/8 inches actual.

5. Exposed Faces: Basis of Design is Smooth Polished Face, Color: Black.

6. Products: Subject to full compliance with the requirements, provide units from one of the following manufacturers:

    a. Johnson Concrete.
    b. Adams.
    c. Metromont.
    d. New Holland Concrete.
    e. Or approved equal.

C. CLAY FACED BRICK: Facing brick complying with ASTM C 216.

1. Calcium silicate building stone shall meet or exceed the requirements of ASTM C73, Standard Specifications for Calcium Silicate Brick with the following properties:

    a. Grade SW; solid units that have been pressure formed and autoclaved; 3-5/8" bed depth; and as follows:

        1) Norman Brick: Actual Unit sizes are 3- 5/8” x 2-1/4” and 11-5/8”.
        2) Texture: Wirecut
        3) Color: #301-W White
        4) Compressive Strength: 6,815 psi, when tested to ASTM C170.
        5) Absorption: 10.3 percent, when tested to ASTM C97.
        6) Density: 120 lb/ft^3, when tested to ASTM C97.
        7) Modulus of Rupture: 800 psi, when tested to ASTM C99.

2. Products: Subject to full compliance with the requirements, provide the following ‘Basis of Design’ products:

    a. “Taylor Clay Products, Inc.”

1.11 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C 91.

1. For colored aggregate mortar, use natural color or white cement as necessary to produce required mortar color.

B. Aggregate for Mortar: ASTM C 144; except for joints less than ¼ inch thick, use aggregate graded with 100 percent passing the No. 16. sleve.

1. Mortar Aggregates: Natural-colored sand.

C. Portland Cement for grout: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

D. Aggregate for Grout: ASTM C 404.

E. Cold Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

F. Water: Potable.

G. Products: Subject to compliance with requirements, provide one of the following:

1. Masonry Cement:

a. Magnolia Masonry Cement, Blue Circle Cement
b. Brixment; Essroc Materials, Inc.
c. Mortamix Masonry Cement. Holnam, Inc.
d. Centurion Colorbond, Lafarge Corporation
e. Lehigh Masonry Cement, Lehigh Portland Cement Co.
f. Flamingo

2. Cold – Weather Admixture:

a. Accelguard 80, Euclide Chemical Co.
b. Moreseled, W.R. Grace & Co., Construction Products Division
c. Trimix – NCA, Division of ChemRex, Inc.

1.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the 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 UNC Standard 21-15, Proportion Specification.

1. Limit cementitious materials in mortar to Portland cement, mortar cement, and lime.

2. For masonry below grade, in contact with earth, and where indicated, use Type S.

3. For reinforced masonry and where indicated, use Type S.

4. For exterior, above grade, load baearing and non load bearing walls and parapet walls; for interior load bearing walls' for interior non load bearing partitions' and for other applications where another type is not indicated, use Type S.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/ TMS 602 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

E. Mortar for Calcium Silicate Masonry Units:

1. Mortar: Type N proportion, 1:1:6 Portland cement-hydrated lime-sand mix in accordance with ASTM C270 Standard Specification for Mortar for Unit Masonry.

F. Grout for Calcium Silicate Masonry Units:

1. Grout: Maximum 6,500 psi at 28 days.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products:

a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
d. Lanxess Corporation; Bayferrox Iron Oxide Pigments.

2. Color and Texture: As selected by Architect. Provide for two colors as noted on drawings.

1.13 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

7. Provide in lengths of not less than 10 feet with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type spaced not more than 16 inches o.c. and with separate adjustable veneer ties engaging the cross ties. Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least 5/8 inch cover on outside face.

a. Provide ladder – type joint reinforcement with straight or adjustable veneer tie as required, engaging cavity insulation with pinties.

1.14 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless noted otherwise.

B. Hot-Dip Galvanized Carbon Steel Wire: ASTM A 82; with ASTM 153, Class B-2 Coating.

C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366/M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

D. D Steel Plates, Shapes, and Bars: ASTM A 36/A 36M

1.15 BENT WIRE TIES

A. General: Rectangular units with closed ends and not less than 4 inches wide. Z-Shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1 1/4 inches.

1.16 ADJUSTABLE MASONRY VENEER ANCHORS:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

a. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.

b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- thick, steel sheet, galvanized after fabrication.

c. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch- diameter, hot-dip galvanized steel wire.

3. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 213S.

b. Hohmann & Barnard, Inc.; DW-10-X-Seismiclip.

c. Wire-Bond; RJ-711 with Wire-Bond clip.

1.17 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

1.18 CONCEALED FLASHING:

A. Stainless steel core flexible flashing with drainage fabric:

1. Product standard of quality: York Manufacturing, Inc.; York Flash-Vent SS,

2. Accepted products:

a. York Manufacturing, Inc.; York Flash-Vent SS, (www.yorkmfg.com)
b. STS Coatings, Inc.; Wall Guardian Venting Stainless Steel TWF (www.stscoatings.com)
c. Building Materials West Company, Inc.; Evacu-Flash SS (www.evacu-flash.com)

3. Characteristics:

a. Type: Engineered system, with high resistant to damage, composite with a stainless steel with non-asphalt adhesive polymer fabric laminated to one stainless steel and non-woven drainage fabric laminated to opposing face with non-asphalt adhesive.
b. Stainless steel: type 304, ASTM A240. Domestically sourced per DFARS 252.225-7008 and/or DFARS 252.225-7009.

c. Fabrics:
   1) Polymer fabric; laminated back face to stainless steel core
   2) Non-woven drainage fabric: Fabric laminated to front face stainless steel core.
d. Recycled content: stainless steel is 60% recycled
e. Size: Manufacturer's standard width rolls

B. Adhesives, Primers, Prefabricated Corner Units, and Seam Tapes for Flashings: Flashing manufacturer's standard products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

1.19 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

2. PVC: ASTM D 2287, Type PVC-65406.

C. Plastic Weep Hole/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, designed to fill head joint with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.

D. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded 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 approved by Architect to match that of mortar.

E. Cavity Drainage Material: 3/4 inch thick, min. 10 inches high, free draining mesh, made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cav Clear: Masonry Mat.
   b. Sandell Mfg: Mortar Web
   c. Advanced Building Products: Mortar Break
   d. Mortar Net USA: Mortar Net.

1.20 MASONRY CLEANERS

A. Use cleaning methods and materials specifically recommended by brick and mortar manufacturers. Select from the following:

1. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

2. 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.

    a. Submit brick and mortar manufacturer's written acceptance of proposed cleaner.

EXECUTION

1.21 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

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

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

1.22 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

1.23 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

E. For exposed 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. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

F. 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.

1.24 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: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

   1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. Bullnose Corners: Provide bullnose units at all exposed interior outside corners. Select bullnose units whose texture matches the texture of adjoining units.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

F. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

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

J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

1.25 BONDING OF MULTIWYTHE MASONRY

A. Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.

B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide rigid metal anchors not more than 24 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

1.26 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Lay solid brick-size 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.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

1.27 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

1.28 SETTING CALCIUM SILICATE BUILDING STONE

A. Install in accordance with calcium silicate building stone manufacturer recommendations and ACI 530/ASCE5/TMS402, including preparation of units in hot, dry or windy conditions.

B. Mortar joints between units shall be consistent to a thickness of 3/8”.

C. Cut masonry units with wet-saw.

1. Pre-soak units using clean water prior to cutting.

D. Where the ambient air temperature exceeds 100°F or exceeds 90°F with a wind velocity greater than 8 mph, pre-wet masonry units.

E. Construct movement joints as specified per manufacturer’s recommendations.

1.29 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.

2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

1.30 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.

2. Anchor masonry to structural members with flexible 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.

1.31 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.

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 1 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 the perimeter.

1.32 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated or, if not indicated, at intervals not greater than 30 feet. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints (**CJ**) in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces, or install preformed control-joint gaskets designed to fit standard sash block.

2. Install temporary foam-plastic filler in head joints on exposed sides of construction for installation of sealant and backer rod specified in Division 07, Section "Joint Protection." Keep joint free and clear of mortar, and remove filler when unit masonry is complete.

C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07, Section "Joint Protection."

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

1.33 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

1.34 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.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, 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.

C. Install flashing as follows:

1. At multiwythe masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through inner wythe and turn flashing up approximately 2 inches, unless otherwise indicated.

2. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing a minimum of 4 inches at ends and turn flashing up not less than 2 inches to form a pan.

3. Cut flashing off flush with face of wall after masonry wall construction is completed.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

1. Use plastic weep hole/vents or vinyl weep hole/vents to form weep holes.

2. Use wicking material to form weep holes above flashing in brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.

3. Space weep holes 24 inches o.c.

E. Cavity Drainage Material: Place cavity drainage material immediately above flashing in cavities.

F. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated. Use plastic weep hole/vents or vinyl weep hole/vents 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.

G. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

1.35 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.

1. Payment for these services will be made by Owner.

2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Mortar properties will be tested per ASTM C 780.

C. Grout will be sampled and tested for compressive strength per ASTM C 1019.

1.36 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.

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. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

1.37 MASONRY WASTE DISPOSAL

A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, 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 Division 31, Section "Earthwork."

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, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other steel items not defined as structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Shop primer.
5. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members not to be shop primed.
6. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

D. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, professional engineer and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.

F. Source quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

A. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE or A qualified installer with a minimum of five years of experience in erecting steel buildings similar in design and complexity to those indicated for this project. Installer shall submit qualifications for approval.

B. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided 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 F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

a. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
b. Use Load and Resistance Factor Design; data are given at factored-load level.

C. Moment Connections: Type PR, partially restrained, bolted end plate.

D. Construction: Braced frame.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M**.**

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Plain.

B. Headed Anchor Rods: ASTM F1554, Grade 36.

1. Nuts: ASTM A563 heavy-hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Plain.

C. Threaded Rods: ASTM A36/A36M].

1. Nuts: ASTM A63 heavy-hex carbon steel.
2. Washers: ASTM F436, Type 1, hardened carbon steel.
3. Finish: Plain.

2.5 PRIMER

A. Steel Primer:
1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2, “Hand Tool Cleaning”.
2. SSPC-SP 3. “Power Tool Cleaning”.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 SOURCE QUALITY CONTROL

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. The Fabricator shall be a designated AISC-Certified Plant, Category STD or the Fabricator at their expense shall engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports, this expense shall be added to the Non-Certified Fabricator’s bid.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

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 on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing 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 in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate, where noted in drawings.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3) Ultrasonic Inspection: ASTM E164.
4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. Joist accessories.

B. Related Requirements:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Steel Decking" for field installation.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and professional engineer.

B. Welding certificates.

C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 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" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."

B. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

C. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 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 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:

a. Roof Joists: Vertical deflection of 1/240 of the span.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type R top-chord extensions where indicated, complying with SJI's "Specifications."

E. Camber joists according to SJI's "Specifications.".

F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.3 PRIMERS

A. Primer: SSPC-Paint 20 – Zinc-Rich Coating (Type 1 Inorganic and Type II Organic).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 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 (0.025 mm) 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.

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; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

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

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
2. Apply a compatible primer of same type as primer used on adjacent surfaces.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

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 deck.

B. Related Requirements:
1. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.

11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches (38 mm) and 3 inch (76 mm).
4. Design Uncoated-Steel Thickness: 0.0358 inches.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Provide Hilti X-HSN 24 pins at bar joist supports.
2. Provide Hilti X-ENP 19 pins at structural steel supports, for steel ¼” think or greater.
3. Fastener spacing: Provide a 36/4 fastening pattern otherwise unless noted on plan.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches (914 mm), or as noted on plans and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. 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 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing.
   2. Soffit framing.

B. Related Requirements:

   1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
   2. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

   1. Design Loads: As indicated.

   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
      b. Interior Non-Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
      c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.

   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

      a. Upward and downward movement of 3/4 inch (19 mm) at non-load bearing walls only.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing

engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Preinstallation Conference: Conduct conference at Project site.

1.7 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 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. AllSteel & Gypsum Products, Inc.
2. California Expanded Metal Products Company.
3. ClarkWestern Building Systems, Inc.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Mfg., Inc.
6. Custom Stud Inc.
7. Design Shapes in Steel.
8. Dietrich Metal Framing; a Worthington Industries Company.

9. Formetal Co. Inc. (The).
10. MarinoWARE.
11. Nuconsteel; a Nucor Company.
12. Olmar Supply, Inc.
13. Quail Run Building Materials, Inc.
14. SCAFCO Corporation.
15. Southeastern Stud & Components, Inc.
16. State Building Products, Inc.
17. Steel Construction Systems.
18. Steel Network, Inc. (The).
19. Steel Structural Systems.
20. Steeler, Inc.
21. Super Stud Building Products, Inc.
22. Telling Industries, LLC.
23. United Metal Products, Inc.
24. United Steel Manufacturing.

B. Cold-Formed Steel Framing Design Standards:
1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

C. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

D. 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 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: As required by design..
3. Section Properties: As required by design..

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. AllSteel & Gypsum Products, Inc.
b. ClarkWestern Building Systems, Inc.
c. Dietrich Metal Framing; a Worthington Industries company.
d. MarinoWARE.
e. SCAFCO Corporation.
f. Steel Network, Inc. (The).
g. Steeler, Inc.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
b. Flange Width: 1 inch (25 mm) plus the design gap of 3/4 inch.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
b. Flange Width: 2 ¾ inches.

2.4 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: Minimum allowable calculated section modulus = 0.380 in^3, moment of inertia = 0.697 in^4, and allowable moment = 7502 in-lbs.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) 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 (3 mm).

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 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. 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.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. 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 (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install double deep-leg deflection tracks and anchor outer track to building structure.
2. Connect vertical deflection clips to infill studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Shelf angles.
3. Metal ladders.
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Division 05 Section "Structural Steel Framing."

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: 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.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 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 anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Machine Screws: ASME B18.6.3.

E. Lag Screws: ASME B18.2.1.

F. Wood Screws: Flat head, ASME B18.6.1.

G. Plain Washers: Round, ASME B18.22.1.

H. Lock Washers: Helical, spring type, ASME B18.21.1.

I. 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, conducted by a qualified independent testing agency.

J. 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 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.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

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. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

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. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Space siderails of elevator pit ladders 12 inches apart.
3. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
4. Rungs: 3/4-inch-diameter steel bars.
5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Prime exterior ladders, including brackets and fasteners, with zinc-rich primer.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Provide steel sheet for cants in elevator hoistway as required by elevator manufacturer and elevator code.

D. Galvanize exterior miscellaneous steel trim.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

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.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to

improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring.

1.2 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 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. 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.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

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

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or 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 blocking, furring, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use treatment that does not promote corrosion of metal fasteners.

2. Use Exterior type for exterior locations and where indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

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

1. Concealed blocking.
2. Roof construction.

2.4 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. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where 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. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach carpentry work to substrate by anchoring and fastening as required.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

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 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION 061000

SECTION 061600 – SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wall sheathing.
2. Sheathing joint-and-penetration treatment.

B. Related Section includes the following:

1. Division 06 Section "Miscellaneous Rough Carpentry" for plywood backing panels.

1.2 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. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
5. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood, unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Comply with performance requirements in AWPA C27.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.

B. Kiln-dry material after treatment to maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat all plywood, unless otherwise indicated.

1. Plywood wall sheathing at back of parapet walls and where indicated.

2.4 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior sheathing, 3/4-inch thick.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation or equal.
2. Type and Thickness: Regular, 1/2-inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

B. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: 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.

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: 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 board and with a history of successful in-service use.

2.7 MISCELLANEOUS MATERIALS

A. Termination Bar: 1/8 inch thick by 1-1/4 inch high galvanized steel with screw holes at 12 inches o.c.

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.

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. NES NER-272 for power-driven fasteners.
2. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. 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 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

3.3 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 boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install boards 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 boards but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board 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 boards.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion 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.

3.5 FLASHING INSTALLATION

A. See Division 04 "Unit Masonry" for thru-wall flashing.

1. Extend flashing up face of sheathing minimum 4 inches above top of cavity drainage material and attach continuous termination bar with screws at 12 inches o.c. and apply continuous bed of sealant.
2. Lap building wrap over flashing minimum 8 inches and tape bottom edge.

END OF SECTION 061600

SECTION 06 16 13 – STRUCTURAL INSULATED SHEATHING WITH FACTORY APPLIED AIR AND WATER-RESISTANT MEMBRANE COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural Insulated Sheathing exterior wall panels, manufacturer, components, and Accessories

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete
B. Section 04 20 00 – Unit Masonry
C. Section 05 40 00 – Cold Formed Metal Framing
D. Section 07 21 00 – Thermal Insulation

1.3 REFERENCE STANDARDS

A. ASTM E84 - “Standard Test Method for Surface Burning Characteristics of Building Materials”.
B. ASTM D137-12 - “Standard Test Method for Evaluating Properties of Wood based Fiber and Particle Panel Materials”, Section 15: Nail Head Pull Through.
C. ASTM E2357 - “Air Leakage of Building Assemblies”.
D. ASHRAE 90.1-2013 - “Energy Standard for Buildings Except Low-Rise Residential Buildings”.
E. ASTM E283-04 (2012) - “Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen”.
F. ASTM E331-00 (2016) - “Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference”.
G. Testing Application Standard (TAS) 202-94 - “Impact & Nonimpact Resistance Building Envelope Components using Uniform Static Air Pressure”.
H. Testing Application Standard (TAS) 203-94 - “Criteria for Testing Products Subject to Cyclic Wind Pressure Loading”.
I. ASTM E72-05 - “Standard Test Method of Conducting Strength Tests of Panels for Building Construction”.
J. ASTM C518-17 - “Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter”.
K. ASTM D1929-12 - “Standard Test Method for Determining Ignition Temperature of Plastics.
L. ASTM E96-13 - “Test Method for Water Vapor Transmission of Materials”.
M. ASTM C1304-08 (2013) - “Standard Test Method for Assessing the Odor Emission of Thermal Insulation Materials”.
N. ASTM C1338-14 - “Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings”.
O. ASTM D1761 - “Standard Test Methods for Mechanical Fasteners in Wood” modified for Shear”.
P. NFPA 285 (2012) - “Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components”.
Q. ASTM E119-07 - “Standard Test Methods for Fire Tests of Building Construction and Materials”.

1.4 SUBMITTALS

A. See Section 01 33 00 – Administrative Requirements for submittal procedures.
B. Manufacturer’s Product Data: Submit data sheets for structural insulating sheathing and accessories. Include instructions for handling, storage, installation, and protection.
C. Manufacturer’s Installation Instructions: Indicate special handling criteria, installation sequence, cleaning procedures, and standard installation procedures.
D. Manufacturer’s demonstrated compliance with NFPA 285 assembly.

E. Sample product warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a company that regularly manufactures and assembles structural insulated sheathing in its own fabrication and owned facilities.
B. Field Quality Control Plan:
   1. Visually inspect fasteners, flashings, and waterproofing.
   2. Photographically document observations and maintain record of observations.
C. Installer Qualifications: Company specializing in performing the work of this Section with minimum [3] [4] [5] years of experience.

1.6 PRE-INSTALLATION MOCK-UP ASSEMBLY

A. See integrated mock-up as indicated on the drawings.
B. Construct mock-up, including panels, attachments to building frame, sealants and seals.
C. Demonstrate component assembly including panel materials, corners (inside and outside), window openings, weep drainage system, attachments, anchors, and perimeter sealant.
D. Locate where directed by Architect and Owner.
E. Mock-up may remain as part of the Work if approved by Architect and Owner.
F. Participants: Authorized representatives of the Contractor, Architect, Installer, and Manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle items in accordance with manufacturer’s instructions.
B. Coordinate deliveries in order to avoid delay in, or impediment of, progress of the Work.
C. Store packaged materials in original containers with seals unbroken and labels, including grade seal, intact until time of use, in accordance with manufacturer’s instructions. Do not stack.
D. Store installation system materials in a dry location and handle in a manner to prevent chipping, breakage, and contamination.
E. Store ArmorWall structural insulating sheathing boards off ground, under cover, and keep dry. Pallets shall sit on even gravel or concrete surface when able.
F. Maximum panel stack height thirty (30) panels. Do not double stack pallets.
G. Long term panel storage shall be kept in a warehouse condition.
H. Protect latex additives, organic adhesives, epoxy adhesives and sealants from freezing or overheating in accordance with manufacturer's instructions; store at room temperature when possible.
I. Protect insulated panels from prolonged UV and weather exposure prior to installation. Edges of panels shall remain covered in factory wrapped packaging prior to installation. Outdoor storage prior to installation requires a waterproof tarpaulin and elevated storage above ground level a minimum of four (4) inches if removed from factory pallet shipping platform.

1.8 SEQUENCING

A. Coordinate with the installation of thermal insulation and steel framing as specified in Section 07 21 00 and Section 05 40 00.
B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
B. Sheathing panels may be installed at any temperature.
C. Special consideration shall be followed for accessory sealants. Follow manufacturer’s instructions for temperature limitations on seam sealant requirements.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide manufacturer's Limited Ten-Year Warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. DuPont: 1335 Litton Drive, Salisbury, North Carolina 28147; www.armorwall.dupont.com; 1-844-629-4968.
Email: armorwall.customerservice@dupont.com
B. Requests for substitutions will be considered in accordance with provisions of Section 00 60 60.

2.2 INSULATED SHEATHING

A. ArmorWall Plus:
1. Type: UL Classified and Audited Production:
a. Magnesium Oxide (MgO) Board Facer; 1/2" (12 mm) thickness.
2. Fused Rigid Foam Insulation:
a. Class 1 Rated Urethane Insulation.
b. Fused directly to rear face of sheathing layer.
1) Laminations are not acceptable.
c. Closed Cell Content equal to or greater than 90%.
3. Air and Water-Resistive Barrier:
a. Factory applied vapor permeable:
1) ASTM E96 Method B Water Vapor Transmission: 18 perms at 10 mils.
2) ASTM E2178 Air Permeance: 0.0005 cfm/sf at 1.57 psf.
4. Panel Size:
a. 4 feet by 8 feet (1220 mm by 2440 mm).
5. Thickness / R-Value per ASTM C518:
a. 2 inches (50.8 mm) composite thickness with R-Value of R-10.
b. 2 ¾ inches (69.85 mm) composite thickness with R-Value of R-15.
c. 3 ¾ inches (95.25 mm) composite thickness with R-Value of R-21.

2.3 PANEL FASTENERS

A. Fasteners shall be approved ArmorWall panel fasteners. Fasteners are corrosion resistant type with oversized heads. Length of fasteners shall be as determined by the panel manufacturer.
1. ArmorWall panels require Concealor Low Profile Fasteners #14-13 DP1 with Tri-Seal Long-Life Coating.
a. For use in 18-gauge or higher steel:
1) Minimum fastener penetration of through the steel with a minimum of three (3) threads showing on the opposite face.
b. For use in wood frame members:
1) Minimum of one-inch embedment into wood substrate.
c. For use in concrete substrates:
1) Pre-drill panel and concrete substrate using a 3/16" (0.187") masonry drill bit.
2) Install fastener using a 2,000 RPM hammer drill.
3) Minimum embedment depth into substrate of one-inch.
4) Do not exceed one one-half inch embedment.
2. ArmorWall panels require Concealor Low Profile Fasteners ¼-14 DP3 with Tri-Seal Long-Life Coating.
a. For use in 18-gauge steel to ¼" plate steel:
1) Minimum fastener penetration of through the steel with a minimum of three (3) threads showing on the opposite face.

2.4 ACCESSORIES

A. Joints and Fastener Heads shall be covered with manufacturer required sealant and/or coating.
   1. ArmorSeal Sealant gunnable grade polyether sealant.
B. Rough Openings in Fire Rated Assemblies and Walls
   1. ArmorBoard Plus returns factory sized to width of full rough opening depth.
   2. ArmorBoard Plus shall be field trimmed to width of full rough opening depth.
C. Window and Door Sills shall be coated with manufacturer required coating.
   1. ArmorSeal Sealant brush grade polyether sealant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.
B. Do not begin installation until exterior walls have been properly prepared.
C. Verify that all exterior wall assembly construction has been completed to the point where the insulation may correctly be installed.
D. Verify built-in items, penetrations and rough openings are correct and properly located.

3.2 PREPARATION

A. Protect surrounding area from possible damage during installation of structural insulated sheathing.
B. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
C. If deficiencies exist, consult Architect. Correct deficiencies in accordance with manufacturer's recommendations.
D. Beginning installation constitutes Contractor's acceptance of existing conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install without gaps or voids. Do not compress insulation.
C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
E. Exposed insulation must always be protected from open flame and kept dry.
F. Fasten structural insulated sheathing to the structural base wall.
G. Exterior wall insulation layer is not intended to be left exposed for extended periods of time in excess of fifteen (15) days without adequate protection. If extended exposure is anticipated all exposed foam surfaces including corners, window and door openings, should be covered with a compatible waterproof tape. Contact MaxLife Industries for guidance on exposed materials.
H. Install ArmorSeal sealant (gunnable grade) at all fastener heads, seams, inside and outside corners providing a one-inch seal in either direction of each seam or opening.

3.4 FIELD QUALITY CONTROL AND TOLERANCES

A. See Section 01 40 00 – Quality Requirements, for additional requirements.
B. Perform field quality control inspection as specified in Part 1, Quality Assurance.
C. Joint thickness: No gaps greater than ¼ inch allowed without installation of supplemental low-rise field applied foam insulation and backer rod for sealants.

3.5 PROTECTION

A. Protect installed products until completion of project.
B. Cover the top and edges of unfinished wall panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
C. Wet panels shall be allowed to completely dry prior to application of cladding.

D. Do not leave factory coated air and weather barrier surfaces exposed to weather longer than one hundred eighty (180) days without approval from manufacturer.
E. Repair or replace damaged products before Substantial Completion.

END OF SECTION 061613

SECTION 062000 – FINISH CARPENTRY

PART 1 - GENERAL

1.1 THIS SECTION INCLUDES

A. Finish carpentry items.

B. Hardware and attachment accessories.

1.2 RELATED REQUIREMENTS

A. Section 064116 – Interior Architectural Woodwork: Shop fabricated custom cabinet work.

B. Section 099113 - Exterior Painting: Painting and finishing of finish carpentry items.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

D. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

1.4 SUBMITTALS

A. See Section 013300 - for submittal procedures.

B. Product Data:

1. Provide data on fire retardant treatment materials and application instructions.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Custom grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire retardant requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

B. Protect work from moisture damage.

PART 2 – PRODUCTS

2.1 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.3 LUMBER MATERIALS

A. Hardwood Lumber: Premium grade clear red oak species, plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.4 SHEET MATERIALS

A. Softwood Plywood: PS 1 Grade A-B; Veneer core; red oak face species, plain sliced cut.

2.5 FASTENINGS

A. Fasteners: Of size and type to suit application.

B. Concealed Joint Fasteners: Threaded steel.

2.6 ACCESSORIES

A. Lumber for Shimming and Blocking; Softwood lumber of pine species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.7 WOOD TREATMENT

A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

B. Provide identification on fire retardant treated material.

C. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

D. Redry wood after pressure treatment to maximum 19 percent moisture content.

2.8 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

C. See Section 061000 Rough Carpentry for installation of recessed wood blocking.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.3 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 099123 Interior Painting.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 064023 – INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Specially fabricated plastic-laminate cabinets.
2. Plastic-laminate countertops.
3. Solid-surfacing-material countertops and window sills.
4. Shop finishing of interior woodwork.
5. Cabinet hardware.
6. Preparation for installing utilities.

B. Related Sections include the following:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking, required for installing woodwork and concealed within other construction before woodwork installation.

1.2 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

E. AWI (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork institute.

F. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Federal Specifications and Standards; Revision A, 1996.

G. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

H. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; National Hardwood Lumber Association; 2011.

I. PS 1 - Structural Plywood; 2009.

1.3 DEFINITIONS

Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 ACTION SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories, and finishing materials and processes.

C. 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 appliances, plumbing fixtures, faucets, and other items installed in architectural woodwork.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.

2. Plastic laminates.

3. PVC edge material.

4. Thermoset decorative panels.

5. Solid-surfacing materials.

E. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.

2. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.

3. Solid-surfacing materials, 6 inches square.

4. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

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.

B. Installer Qualifications: Fabricator of products.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Custom quality.

E. Perform cabinet construction in accordance with AWI Architectural Woodwork Quality Standards Illustrated as follows:

1. Wood Veneer Cabinets: Premium Quality.

2. Plastic Laminate Cabinets: Custom Quality.

3. Drawer and Door Front Construction: Custom Quality.

F. Work in this section shall be performed by a firm licensed by the AWI Quality Certification Program and shall comply with the specified grades of work and sections of the current edition of the AWI Quality Standards.

G. Certification shall be evidenced through the application of AWI Quality Certification Labels and/or the issuance of an AWI Letter of Licensing for the project.

H. Certification Labels shall be applied to each item of work.

I. Workmanship: Comply with the requirements of the Architectural Woodwork Institute Quality Standards (current edition) Custom Grade except as noted. Following Section of the Quality Standards shall be referenced:

1. Wood and Plastic laminate Cabinets - Section 400A and 400B.

2. Work Counters - Section 400C.

3. Reception Desks and Nurses Stations - Section 400A and 400B.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

B. Delivery: Do not deliver architectural woodwork items to job site until building is sufficiently conditioned to prevent damage by moisture, dampness, excessive humidity, extreme dryness, heat or cold. Do not deliver woodwork until wet work, painting, or grinding and similar "rough" trades in storage and installation areas, which could damage, soil or deteriorate woodwork, have been completed.

C. Storage: Store architectural woodwork in enclosed areas having same temperature and humidity conditions as areas in which millwork will be installed.

D. Damaged Items: Remove from site immediately all items damaged due to improper handling or storage.

1.8 FIELD CONDITIONS

A. During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

B. Environmental Limitations: Do not deliver or install woodwork 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.

C. Field Measurements: Where woodwork is 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 woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. 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 interior architectural woodwork can be supported and installed as indicated.

PART 2 – PRODUCTS

2.1 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.3 LUMBER MATERIALS

A. Softwood Lumber: NIST PS20, Graded in accordance with AWI-P-200, Custom; average moisture content of 6 percent, species as approved by the Architect.

B. Hardwood Lumber: NHLA G-101 graded in accordance with AWI P-200, Custom; average moisture content of 6 percent; species as approved by the Architect.

2.4 PANEL MATERIALS

A. Particleboard: ANSI A208.1, AWI P-200 standard, composed of wood chips, AWI P-200 medium density, made with veneer; of grade to suit application ; sanded faces.

B. Low Pressure Laminate: Thermofused melamine products shall meet the performance standards of a "Permalam" certified product and meet or exceed standards for NEMA LD-3 for GP-28. Manufacturer supplied documentation confirming these standards shall be submitted with the shop drawings. The edges of all melamine surfaced panels shall be clean and straight without noticeable chipping. Any and all panels with chipped or rough cut edges shall be refabricated at the Contractor's expense. Thermofused melamine products manufactured by Panval, Masonite, Funder or Domtar only will be accepted.

C. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S); use for drawer bottoms.

2.5 MANUFACTURERS - PLASTIC LAMINATE

A. Formica Corp: www.formica.com.

B. Nevamar, International Paper: www.nevamar.com.

C. Pionite : www.pionite.com.

D. Wilsonart International, Inc: www.wilsonart.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 LAMINATE MATERIALS

A. Plastic Laminate: In accordance with AWI Quality Standards Illustrated, 0.039 inch Post Forming quality; color, pattern, and surface texture as selected.

B. Laminate Backing Sheet: 0.020 inch Backing sheet grade, undecorated plastic laminate.

2.7 SOLID SURFACING

A. Solid Surface Countertops:

1. Colors and Patterns: As indicated on Drawings.

2.8 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins and Screws: Of size and type to suite application.

D. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.9 HARDWARE

A. General Requirements: The products of the following manufacturers are used herein and the accompanying abbreviations for the company name are used at the product designation.

B. Hardware Finish: US26D (Satin Chrome) for plastic laminate finish and US10B (Brass) for wood veneer finish.

C. Manufacturers:

1. BA - Baldwin Hardware Mfg. Corp.
2. BL - Julius Blum Mfg.
3. BO - Bommer Spring Hinge Co., Inc.
4. BA - Garcy Corporation
5. GR - Grant Pully & Hardware Co.
6. GRA - Grass America
7. HA - Hager Hinge Co.
8. HF - Hafele
9. IV - The H. B. Ives Co.
10. KV - Knape and Vogt
11. McK - McKinney Sales Co.
12. NCL - National Cabinet Locks
13. ST - Stanley Hardware

D. Hinges and Baseplates:

1. For 3/4" thick doors: Julius Blum 170 degree opening hinge, Product Number 71.6530 used in conjunction with baseplate 175H9100, zinc die cast, two-piece, wing type. Mount baseplate with two 5mm system screws and #7 wood screw (3 screws total each baseplate) or approved equal.

2. Number of hinges per door shall depend on weight and size of door. Following information is only a guideline and it is the responsibility of the contractor to ensure that a sufficient number of hinges are installed to prevent sagging or binding.

3. # of Hinges:	Door Height:	Door Weight:
a. 2	Less than 36"	Less than 15 lbs.
b. 3	Less than 66"	Less than 30 lbs.
c. 4	Less than 84"	Less than 45 lbs.
d. 5	Less than 96"	Less than 60 lbs.

E. Pulls:

1. For doors and drawers:

a. No. 4484 as manufactured by ST.

b. No. 4676 as manufactured by BA.

F. Drawer Slides:

1. No. 1300 as manufactured by KV.

2. No. 6020 as manufactured by GRA.

3. No. BS220E as manufactured by Blum.

4. No. 214 Ball Bearing manufactured by Accuride.

5. Note: Provide full-extension drawer slides (KV 1429, Accuride 3832 or equal) for all file type drawers and for other drawers as indicated on the Drawings. Provide 3/4 slides for all other locations.

G. Drawer Locks: No. 987 as manufactured by KV.

H. Adjustable Shelf Supports: Standard back-mounted system using multiple holes for pin supports and coordinated cantilevered shelf brackets, white finish, for nominal 1 inch spacing adjustments with top locking tab for shelf.

2.10 SLIDING GLASS WINDOW UNIT:

A. Sliding glass window unit, including countertop shall be as indicated on the Drawings. Glass shall be 1/4" clear tempered glass as manufactured by Ford Glass, PPG, Guardian, or approved equal. Provide pulls and locking device. Track for sliding glass unit shall be as follows:

1. No. P1092 with No.1087 Bumpers and No. 1085 Vinyl Guides by Knape & Vogt or approved equal.

2.11 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. Fit shelves, doors, and exposed edges with 3/8 inch matching hardwood edging. Use one piece for full length only.

C. Cap exposed plastic laminate finished edges with material of same finish and pattern.

D. Door and Drawer Fronts: 3/4 inch thick; flush style.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

G. Apply wood laminate by grain matching adjacent sheets to book matching.

H. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

I. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

J. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

2.12 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 1500, System TR-2 (Transparent).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Building temperature and humidity shall be maintained prior to installation of casework.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

H. Caulk all cabinets, fascia panels, backsplashes, etc.. to adjacent walls with color matching caulk or use paintable caulk and paint to match wall color.

I. Provide aluminum cleats to support countertop at open exposed areas at wall conditions. Ease edges at cut cuts where there is possible public / staff access.

3.3 ADJUSTING AND CLEANING

A. Clean counters, shelves, fittings, and fixtures.

B. 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.

C. Clean, lubricate, and adjust hardware.

D. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 068300 – SOLID POLYMER FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hard Surface Countertops.

B. Window sills and aprons.

1.2 RELATED SECTIONS

A. Section 064116 – Interior Architectural Woodwork.

1.3 REFERENCES

A. ANSI - American National Standards Institute

B. ASTM - American Society for Testing and Materials

C. NEMA - National Electrical Manufacturers Association

D. FS - Federal Specifications

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Provide data to indicate product description, fabrication information and compliance with specified performance requirements.

C. Shop Drawings: Submit shop drawings for all items fabricated for this project and submit manufacturer's cuts, and/or details for all stock items. Shop drawings shall indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

D. Samples: Submit two minimum, 2 x 2 inch samples. Indicate full range of color and pattern

E. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

1.5 QUALITY ASSURANCE

A. Variation in component size: 1/8 inch.

B. Location of Openings: 1/8 inch from indicated location.

1.6 PRODUCT HANDLING

A. Delivery: Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.

B. Handling: Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

C. Damaged Items: Remove from site immediately all items damaged due to improper handling or storage.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's ten (10) year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Solid Polymer Fabrications:

1. Dupont
2. Formica
3. Nevamar
4. Substitutions: See Section 012500 – Substitution Procedures.

2.2 SOLID POLYMER FABRICATIONS (COUNTERTOPS)

A. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six and Fed. Spec. WW-P-541E/GEN.

1. Material shall have minimum physical and performance properties specified herein.
2. Superficial damage to a depth of 0.010 inch shall be repairable by sanding and polishing.

B. Countertops: Molded countertops shall be 1/2 inch thick. Edge details shall be as indicated on the Drawings.

C. Performance Characteristics: (PROPERTY; REQUIREMENT; TEST PROCEDURE)

1. Tensile Strength; 6000 psi; ASTM D 638
2. Tensile Modulus; 1.5 x 106 psi; ASTM D 638
3. Flexural Strength; 7890 psi; ASTM D 790
4. Flexural Modulus; 1.4 x 106 psi; ASTM D 790
5. Elongation; 0.4%; ASTM D 638
6. Strain at Break; 0.81%; ASTM D 638

7. Work to Break; 2.48 in. lbs; ASTM D 638
8. Hardness; 94 Rockwell "M", Scale 56 Barcol Impressor; ASTM D 785
9. Thermal Expansion; 3.02 x 10-6 in/in/C, 1.80 x 10-6 in/in/F; ASTM D 696

2.3 ACCESSORY PRODUCTS

A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints with a chemical bond.

B. Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A 136.1-1967, UL listed.

C. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in color matching or clear formulations.

2.4 FABRICATION

A. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings.

B. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2 inch wide reinforcing strip of polymer material under each joint.

C. Provide holes and cutouts for plumbing as required.

D. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

E. Finish: All surfaces shall have uniform finish in color as selected by the Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

3.2 INSPECTION OF SURFACES

A. Before installation begins, inspect all areas to receive work as follows:

B. For any deficiency which might prevent satisfactory installation of solid polymer fabrications.

C. For presence and proper positioning of anchoring devices built into work as required by approved shop drawings.

D. Acceptance of Surfaces: Do not start work until deficiencies of surfaces to receive work have been corrected. Beginning of installation in any area shall constitute acceptance of that area as satisfactory to receive this work. Contractor shall be fully accountable for final results and workmanship specified herein.

3.3 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings and product installation details.

B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

C. Adhere to countertops using manufacturer's standard color-matched silicone sealant.

D. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.

E. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

F. Make plumbing connections to sinks in accordance with Division 15.

G. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to Architect's satisfaction.

H. Fabricator/Installer shall provide maintenance instructions and review maintenance procedures and the warranty with the head of maintenance upon completion of the project.

3.4 CLEANING

A. At completion of all solid polymer installations, clean up all areas in which work was performed and leave ready for installation of related work. Repair damaged or defective work as directed.

END OF SECTION

SECTION 072100 – THERMAL INSULATION

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. Glass-fiber blanket insulation.
2. Mineral-wool blanket insulation.

1.3 QUALITY ASSURANCE

A. Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

B. Thermal insulation shall meet the 2012 North Carolina Energy Conservation Code requirements for climate zone 3.

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.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

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. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Acoustical Blanket Insulation: 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. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated per Construction Dcouements and the 2012 North Carolina Energy Conservation Code.
2. Width: As required for friction fitting between wood framing members.

C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

2.2 MINERAL-WOOL BLANKET INSULATION

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. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Where slag-wool-fiber/rock-wool-fiber blanket insulation is indicated for firesafing or other applications, provide blankets in thickness indicated.

2.3 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

D. Fiberglass Batt Impaling Clips: Adhere metal four-barb insulation clips to back of substrate with clip manufacturer's approved adhesive. Use clips on 16" wide wall batts longer than 8'-0" tall and all overhead and sloped substrates. Six clips minimum required on 16" x 8'-0" batts on overhead and sloped substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

E. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

F. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical 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 (610 mm) below exterior grade line.

B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

C. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool 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 (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
    b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of partitions.

3.5 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 072100

SECTION 072670.13 – BELOW SLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Vapor Retarder
2. Seam Tape
3. Pipe Boots

B. Warranty

1. Manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Stego Wrap Vapor Barrier (15 mil) by Stego Industries LLC or equal.

1. Properties:

a. Tensile Strength: ASTM E 1745 Class A minimum.
b. Puncture Resistance: ASTM D 1709, Method B: not less than 2200 grams minimum.
c. Water Permeance: Less than 0.01 Perms as tested in accordance with ASTM E 1745 Section 7

B. Composition:

1. Vapor retarder to be 15-mil minimum polyolefin film manufactured with a formulation of virgin resins.

C. Accessories:

1. Vapor Bond Tape: Manufacturers standard, not less than 4-inches wide.
2. Pipe Boots: Manufacturers standard, furnished with vapor retarder.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Level and tamp or roll soil or granular base. Unroll film with longest dimension parallel with direction of the pour.

B. Lap film over footings and seal to foundation walls.

C. Overlap joints 12-inches and seal completely with manufacturers Tape and seal all penetrations (including pipes) with per vapor retarder manufacturer's instructions.

D. Do not penetrate vapor retarder except for required reinforcing steel and permanent utilities.

E. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 12-inches and taping all sides with Bond Tape.

F. Remove loose gravel, dirt, and construction debris for vapor retarder.

G. Vapor retarder is to be dry and free of standing water.

END OF SECTION 072700613

SECTION 074213.13 – FORMED METAL WAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.

B. Shop Drawings:

1. 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.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

1. Include Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 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.

1.8 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.

1.9 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.

1.10 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. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show 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.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: Five 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. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 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: 6.24 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 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches o.c. across width of panel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AEP Span; A BlueScope Steel Company.
b. ATAS International, Inc.
c. CENTRIA Architectural Systems.
d. Englert, Inc.
e. Fabral.
f. Firestone Building Products.
g. MBCI; a division of NCI Group, Inc.
h. McElroy Metal, Inc.

2. 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. Nominal Thickness: 0.028 inch.
b. Exterior Finish: Two-coat fluoropolymer.

c. Color: [As selected by Architect from manufacturer's full range].

3. Rib Spacing: 2.5 to 3.0 inches o.c.
4. Panel Height: 0.75 to 0.87 inch.

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. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and 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. 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.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. 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.

E. 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.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. 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.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

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.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

WOOD VENEER LAMINATE WALL SLATS (ONE SIDING)
(For Use on Exterior Vertical and Horizontal Applications)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Bidding Requirements, Contractual Conditions, and General Requirements of Division One shall apply to all work hereunder.

1.02 WORK INCLUDED

A. Provide all labor, materials, and equipment necessary to apply the PARKLEX PRODEMA Wood veneer siding over exterior vertical walls and of other acceptable substrates, as indicated on drawings and on these specifications. Included is proper protection of adjacent surfaces and coordination w/other trades.
B. Wood veneer laminate siding or panels.
C. Metal furring and framing (for ceiling application)
D. Accessories

1.03 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.
B. Section 03 30 00 - Cast-In-Place Concrete
C. Section 04 20 00 - Unit Masonry.
D. Section 05 40 00 - Cold-Formed Metal Framing
E. Section 06 16 13 - Structural Insulated Sheathing
F. Section 07 62 00 - Sheet Metal Flashing And Trim
G. Section 07 92 00 - Joint Sealants

1.04 REFERENCES

A. Section Includes:

1. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a
2. AWPA U1 – Use Category System: User specification for Treated Wood; 2012
3. EN 438-7 – High-Pressure Decorative Laminates (HPL); 2005
4. ICC-ES – ESR-3462, PARKLEX PRODEMA NATURSIDING - W Wall Panel Cladding System; 2017

1.05 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Convene conference 1 week before starting work or as required by General Contractor to establish procedures to maintain optimum working conditions and to coordinate work with related and adjacent work.

1.06 SUBMITTALS

A. Product Data: Standard specific and descriptive literature for primary and secondary products, including:
   1. Spec-Data product information sheets, including sub-framing system and accessories.
   2. Catalog cut-sheets.
   3. Color charts.
   4. Safety Data Sheets (SDS).
   5. Building code evaluation reports.
   6. Sample warranty forms.

B. Shop Drawings: Graphic information specifically prepared for this Project, including:
   1. Dimensioned plans, elevations, and construction details indicating full extent of siding work complete with metal furring, attachments, and accessories, conditions at adjacent materials, perimeters and penetrations.
   2. Verified field dimensions.

C. Selection Samples: Color chips for initial color selection prepared on same material as specified products.

D. Verification Samples: Actual siding and trim pieces, 12 inches (305 mm) long, illustrating color, texture and finish selected by Owner

E. Manufacturer's Instructions, including:
   1. Delivery, storage and handling.
   2. Preparation and Installation.
   3. Maintenance.

F. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

G. Commercial Product Warranties: Manufacturer's commercial series of prorated limited warranties including; 10-years against manufacturing defects of composite siding, any additional warranties for components resulting from installation.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized dealer-installer.

B. Installation Documents: Maintain manufacturer's installation instructions, approved submittals, and related documents on-site throughout construction period, to confirm proper installation, until Final Inspection and acceptance by Owner.

C. Fire resistant panel, NATURSIDING - W, shall be stamped with manufacturer's name, address, product name, thickness, color, batch number and evaluation report number (ESR-3462).

D. Mock-Up:
   1. At the locations indicated on drawings, install minimum 48 inch (1219 mm) long by 48 inch (1219 mm) high mock-up, using specified siding boards, trim, accessories, and substrate construction to show:
      a. Substrate preparation.
      b. Blocking, furring and flashing
      c. Attachment details.
      d. Clearances and gaps between members.
      e. Siding pattern, texture, and color.
      f. Include outside corner, window opening, and transition to adjacent materials
      g. Trim details.
      h.. Workmanship.
   2. Prepare mock-up, for [Architect's] approval, before start of siding work. Prepare additional mock-ups, if required by [Architect], until approved.
   3. Maintain approved mock-up during construction to establish required standard of workmanship, and basis of comparison for installation of siding work. Do not remove approved mock-up until directed by [Architect]. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE AND HANDLING

Deliver, store, and handle composite siding in accordance with manufacturer's instructions:

A. Transportation:
   1. Transport panels horizontally and strapped down to avoid sliding across one another.
   3. Protect edges and corners.
   4. Maintain in original protective packaging until use.

B. Storage:
   1. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.
   2. All materials shall be delivered to the job site in the original, unopened packages with labels intact.
   2. Store panels horizontally with supports no more than 31-1/2 (80 mm) inches apart.
   3. Store panels in clean dry location protected from rain and sun within manufacturer's recommended temperature and humidity range.

C. Handling:
   1. Wear protective gloves when handling.
   2. Follow manufacturer's recommendation for dust collection and removal.

1.09 SEQUENCING AND SCHEDULING

A. Installation of the siding shall be coordinated with other construction trades.

1.10 WARRANTY

A. See section 01 77 00, and section 01 78 30 for "Close Out Procedures" and additional "Warranties and Bonds" requirements.

B. Provide manufacturer's standard 10-year warranty covering structural stability, color and finish retention.

PART II – PRODUCTS

2.01 GENERAL

A. All siding products shall be supplied by the manufacturer or its authorized distributors. Substitutions or additions of other materials will void the warranty.
B. Single Source Responsibility: Furnish primary products, secondary products, and warranty for work of this Section from same source per manufacturer's recommendation.

2.02 MANUFACTURERS

A. PARKLEX PRODEMA USA, Inc.; 218 River Park North Drive, Woodstock, GA 30188; telephone: 678-401-7403; website: http://www.PARKLEX PRODEMA.com
B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 00 60 60.

2.03 APPLICATION

A. System Type – 1: Wall Siding
   1. Description: Siding system
   2. Panel Type: PARKLEX PRODEMA NATURSIDING - W S (standard)
   3. Fastening System: One Siding
   4. Finish: To be selected by owner

2.04 MATERIALS

A. Panels: High Pressure Compact Laminate, composing of wood veneer and paper fibers treated with thermosetting resins, designed for flush assembly.
   1. Slat Type: PARKLEX PRODEMA NATURSIDING - W S (standard)
   2. Size: 7.4 by 96 inches (198 by 2440 mm), 5.4 by 96 inches (137 by 2440 mm) & 11.4 by 96 inch (300 by 2440mm)
   3. Thickness: 5/16" (8 mm)
   4. Edge: Machined
   5. Mounting Method: One Siding.
   6. Finish: To be selected by Owner
B. Soffit Panels: High Pressure Compact Laminate, composing of wood veneer and paper fibers treated with thermosetting resins, designed for flush assembly.
   1. Slat Type: PARKLEX PRODEMA NATURSIDING - W S (standard)
   2. Size: 7.75 by 96 inches (198 by 2440 mm) & 11.75 by 96 inch (300 by 2440mm)
   3. Thickness: 5/16" (8 mm)
   4. Edge: Machined
   5. Mounting Method: One Siding.
   6. Finish: To be selected by Owner.
C. Properties; EN438-7:
   1. Dimensional Stability: 0.3 percent cumulative dimensional change
   2. Maximum Height of Impact with No Visible Signs of Cracking: ≥ 1,800 mm

3. Tensile Strength (Long Grain): ≥ 60 MPa
4. Flexural Strength:
   a. Long Grain: ≥ 80 MPa
   b. Cross Grain: ≥ 80 MPa
5. Thermal Resistance:
   a. NATURSIDING - W S: 0.266 k
6. UV Resistance:
   a. Contrast, Gray Scale Rating: ≥ 3
   b. Aspect Rating: ≥ 4
7. Artificial Weathering Resistance:
   a. Contrast, Gray Scale Rating: ≥ 3
   b. Appearance Rating: ≥ 4
8. Water Vapor Permeability:
   a. Wet Cup Method: 100µ
   b. Dry Cup Method: 250µ
9. Density: ≥ 1.35 g/cm3
10. Water Absorption:
    a. NATURSIDING - W S: ≤ 5 percent
11. Fire Resistance:
    a. NATURSIDING - W S: ASTM E84: Class A,

2.05 ACCESSORIES

A. Sub-framing System:
   1. Aluminum; Depth [1] [2.94] inch One Siding Clip

B. Siding System:
   1. Counter sinking fasteners are not allowed for attachment of panels
   2. Wood Screws: TWD-S-D12 with Torx head
   3. Metal Screws: SX3-L12 with Irius head
   4. Aluminum Rivets: AP16 or SSO-D15 based on PARKLEX PRODEMA's recommendation
   5. Clips

Recommended to include the following when wood furring or sub-framing is used

C. PVC joints or closed-cell polyethylene foam.
D. Sealant: Silicone type as specified under Section 07 92 00 – Joint Sealants.
E. Ventilation: Molded plastic or woven polyethylene designed for provide air flow behind panels but restrict insect entering air space.
   1. Product: Cor-A-Vent SV-5 by Cor-A-Vent or equal.

2.06 FINISHES

A. Exterior Panel Finishes: [Cinder] [Cinnamon] [Tobacco] [Mustard] [Sesame] [Chia] [Red] [Black] [Green] [Olivergreen] [Grey] [StoneGrey] [White] [Boreal] [Coffe] [Rustik] [Pale] [Nux] [Ambar] [Hazel] [Hazel Matt] [Onix] [Silver] [Cocoa] [Rubi] [Quartz] [Antra] [Chesnut]
   1.) As selected by Architect from manufacturer's full range.

PART III EXECUTION

3.01 EXAMINATION

A. Verify that conditions of work previously installed under other sections or Contracts are acceptable for installation of siding in accordance with manufacturer's instructions and approved submittals.
   1. Examine substrate and framing members for alignment
   2. Notify Architect of conditions that would adversely affect installation. upon discovery.
   3. Do not proceed with preparation and installation until unacceptable conditions have been corrected.
   4. Ensure that weather barrier is properly installed and undamaged.

3.02 SURFACE PREPARATION

A. Securely install wall furring system plumb and square, and correctly spaced to accommodate panel or slat system.

3.03 INSTALLATION

A. Install panels in strict compliance with manufacturer's written instructions.
B. Use recommended cutting tools, equipment, and procedures.
C. Provide a minimum of 1/4 inch (6 mm) expansion at panel edges.
   1. Do not seal joints.
D. Follow shop drawings for sub-framing support, and fastener location and spacing.
E. Provide minimum 3/4 inch (19 mm) clear air gap behind panels [and install vent strips at top and bottom of wall as detailed]

3.04 SIDING SYSTEM

A. Ensure that One Siding Clip is not spaced greater than 24 inches apart and is set plumb and level.
B. Install the bottom row of clips aligned over the vertical profiles
C. Install the last row of boards using the exposed screw fastening method.
   The boards must be connected to the J shim channels using SX3 No.14-11, stainless steel (Austenitic stainless steel A2 nº1.4567, AISI 304) self-drilling screws for aluminum substructure

3.05 SOFFIT AND DROPPPED CEILINGS

A. Install ceiling of soffit panels using One Siding system described above.
B. Maximum One Siding Spacing:
   1.

Panel Thickness:	Max. Horizontal Spacing:
5/16" (8mm)	23-5/8 inches (600 mm)

3.06 CLEANING

A. Clean stains and excess adhesive from panels following manufacturer's instructions.

1. Do NOT use abrasive cleaning cloths or sponges, or harsh solvents such as acetone, ethyl acetate or MEK (Methyl Ethyl Keytone) on any surface to clean panels.

B. Clean-up packaging, waste material, and construction debris daily during installation; legally dispose of in accordance with authorities having jurisdiction.
C. Upon completion, remove surplus materials, remaining debris, tools and equipment.

3.07 PROTECTION

A. Protect panels from damage by placing thick cardboard corners at building corners, and lining passageways and walls adjacent to material handling routes with protective pads or sheet goods.
B. If boards are damaged during construction or correction period, contact PARKLEX PRODEMA for instructions to send portion of damaged material to PARKLEX PRODEMA for replacement closely matching existing.
C. Protect installed products from damage during subsequent construction until Final Inspection and acceptance by [Owner].
D. Repair damage to adjacent materials caused by installation of siding.

PART 4 - WARRANTY PROTECTION

4.01. WARRANTY

A. This Contractor shall provide a minimum three (3) year warranty for installation and workmanship to begin upon completion of installation.

END OF SECTION

SECTION 075423 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

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. Adhered TPO membrane roofing system.

B. Related Sections:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
5. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. TPO: Thermoplastic polyolefin.

B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane 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. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Qualification Data: For qualified Installer and manufacturer.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

F. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES**.**

G. Field quality-control reports.

H. Warranties: Sample of special warranties.

I. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including fasteners and roof flashing for membrane roofing system from same manufacturer as membrane roofing.

D. Preinstallation Roofing Conference: Conduct conference at Project 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 will affect 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.

1.7 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.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT 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.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, fasteners, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.

Basis-of-Design Product: Subject to compliance with requirements, provide GAF, “Everguard TPO” system, or comparable product by one of the following:

1. Manufacturers: Subject to compliance with requirements:

a. Carlisle SynTec Incorporated.
b. Firestone Building Products Company.
c. Johns Manville.
d. Versico Incorporated.
e. GenFlex Roofing Systems.
f. GAF Materials Corporation.

2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

    a. Plastic Foam Adhesives: 50 g/L.
    b. Gypsum Board and Panel Adhesives: 50 g/L.
    c. Multipurpose Construction Adhesives: 70 g/L.
    d. Fiberglass Adhesives: 80 g/L.
    e. Single-Ply Roof Membrane Adhesives: 250 g/L.
    f. Other Adhesives: 250 g/L.
    g. Single-Ply Roof Membrane Sealants: 450 g/L.
    h. Nonmembrane Roof Sealants: 300 g/L.
    i. Sealant Primers for Nonporous Substrates: 250 g/L.
    j. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane 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.

2.3 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that 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.

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. 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.

3.3 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane 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 membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane 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 membrane.
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 does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.4 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane 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.

3.5 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.

3.6 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will 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 membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane 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.

SEE ATTACHED ROOFING INSTALLERS WARRANTY FORM ON FOLLOWING PAGES.

3.8 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ (name) of _____ (address), herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: _____.
2. Address: _____.
3. Building Name/Type: _____.
4. Address: _____.
5. Area of Work: _____.
6. Acceptance Date: _____.
7. Warranty Period: _____.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. Lightning;
    b. Peak gust wind speed exceeding _____ mph;
    c. Fire;
    d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. Vapor condensation on bottom of roofing; and
    g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

SECTION 076200 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Metal flashing.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 04 Sections for through-wall flashing and other integral masonry flashings specified as part of masonry work.
2. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Division 07 Section "Built-Up Asphalt Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
4. Division 07 Section "Roof Specialties" for copings, scuppers, and roof edge flashings.
5. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
6. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
7. Division 07 Section "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints, including showing direction of expansion and contraction.
6. Details of edge conditions, including crickets and counterflashings as applicable.
7. Details of special conditions.

8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of two or more units showing the full range of variations expected.

1. 12-inch long Samples of factory-fabricated products exposed as finished Work. Include samples of coping at concealed splice plates and scupper. Provide complete with specified factory finish.

D. Qualification Data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated in this Project and with record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.4 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 the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. 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.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal 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.

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.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the 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 without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed 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 as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from the following materials:

1. Aluminum: 0.040 inch thick.

B. Counterflashing: Fabricate from the following materials:

1. Aluminum: 0.040 inch thick.

C. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

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.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. 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. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. 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.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

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 SMACNA.

1. Coat back side of uncoated aluminum and 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 sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Do not solder aluminum sheet.

G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, 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 and weather resistant.

B. 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. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.4 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. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry."

C. Opening Flashings in Frame Construction: Install continuous head, sill,[jamb,] and similar flashings to extend 4 inches beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. 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 076200

SECTION 077100 – ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.
2. Scuppers.
3. Roof-edge flashings.
4. Fascia panels.

B. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section “Built-Up Asphalt Roof Roofing” for installing copings, scuppers, and roof-edge flashings integral with membrane roofing.
3. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
4. Division 07 Section "Roof Accessories" for roof hatches and other manufactured roof accessory units.
5. Division 07 Section "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
6. Division 07 Section "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties 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. 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 pressures:

1. Design Pressure: 83 lbs. per sq. ft.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 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 roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Verification: For copings and edge flashings made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

E. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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 coping and roof edge, including fascia, approximately 10 feet long, including supporting construction, 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.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth, flat finish.
2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
b. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Blind Fasteners for Aluminum: Aluminum or Series 300 stainless steel at copings.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 ALUMINUM COPINGS AND SCUPPERS

A. General: Provide custom-fabricated aluminum copings and scuppers as indicated.

B. Coping: Form coping at roof edge and extend down to form a fascia as indicated. Hook lower edges of fascia over a previously-placed continuous edge strip and bend hooked edge outward at an angle of 45 deg. to form a drip. Turn rear edge down parapet not less than 4 inches and nail through neoprene along back edge of coping on 6-inch centers. Install coping in longest lengths possible except where shorter lengths are required. Provide factory-fabricated and welded corner units, including continuous drip edges. Work shall be orderly and symmetrical. Install sections with 1/4-inch wide joints and provide 6-inch wide concealed splice plates.

1. Provide factory-formed and curved coping sections at circular areas of building.

C. Scuppers: Fabricate as indicated. Coordinate opening with roof system.

D. Aluminum Thickness: 0.050 inch, with a smooth finish (no pattern). At curved or radiused Sections, use 0.063 inch thick aluminum.

E. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Metal Era, Inc.
2. W.P. Hickman Co.
3. MM Systems Corp.
4. Peterson Aluminum Corp.

2.5 ROOF-EDGE FLASHINGS

A. Canted Roof-Edge Fascia and Gravel Stop: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

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

a. Hickman Company, W. P.
b. Metal-Era, Inc.
c. MM Systems Corporation.
d. Petersen Aluminum Corporation.

2. Fascia Cover: Fabricated from the following exposed metal:

a. Formed Aluminum: 0.050 inch thick to match copings.

3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.6 METAL FASCIA PANELS

A. General: Provide factory-formed 1” metal fascia 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 sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Fascia Panels: Formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.

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

1. Metal Era, Inc.
2. W.P. Hickman Co.
3. MM Systems Corp.
4. Peterson Aluminum Corp.

D. Material: Formed aluminum 0.040 inch thick.

E. Panel Width: 16 inches.

F. Panel Height: 1-1/2 inch.

G. Subgirts: C – or Z-shaped sections fabricated from 0.0598-inch bare steel thickness, shop-painted, cold-formed, metallic-coated steel sheet.

H. Zee Clips: 0.079-inch bare steel thickness, cold-formed, galvanized steel sheet.

I. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates designed to withstand design loads.

J. Fascia Panel Accessories: Provide components required for a complete metal fascia panel assembly including trim, copings, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels, unless otherwise indicated.

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. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range

of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

A. Polyethylene Sheet: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.

B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood

substrates, install a course of polyethylene sheet.

3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements.

3.5 ROOF-EDGE FLASHING INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 METAL FASCIA PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Fasten metal fascia panels to supports with fasteners at each lapped joint at location, spacing, and with fasteners recommended by manufacturer.
2. Arrange and nest side-lap joints so prevailing winds blow over, not into lapping joints. Apply panels and associated items for neat and weathertight enclosure.
3. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weatherproof to driving rains.

3.7 SCUPPER INSTALLATION, GENERAL

A. General: Refer to requirements of Figure 1-30 in the SMACNA Architectural Sheet Metal Manual.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 – ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof hatches.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Division 06 Section "Rough Carpentry" for roof, wood cants, and wood nailers.
3. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Division 07 Section "Roof Specialties" for fascia, copings, and gravel stops.
5. Division 07 Section "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint covers.

1.2 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 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.

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, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated.

2.3 MISCELLANEOUS MATERIALS

A. 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.

B. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

2.4 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated single-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Available Manufacturers:

    a. Babcock-Davis; a Cierra Products Inc. Company.
    b. Bilco Company (The).
    c. Milcor Inc.; a Gibraltar Company.
    d. Nystrom, Inc.
    e. O'Keeffe's Inc.
    f. Precision Ladders, LLC.

2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
3. Type and Size: Single-leaf lid, size as indicated.
4. Curb and Lid Material: Aluminum sheet, 0.090 inch thick.

    a. Finish: Mill.

5. Insulation: Manufacturer's standard insulation.
6. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height constant.
8. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
9. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.

    a. Height: 42 inches above finished roof deck.
    b. Material and Finish: Steel tube, galvanized.
    c. Diameter: Pipe with 1-5/8-inch OD tube.

10. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation.

    a. Height: 42 inches above finished roof deck.
    b. Pipe or Tube: 1-1/4-inch ID galvanized pipe or 1-5/8-inch OD galvanized tube.
    c. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
    d. Pipe Ends and Tops: Covered or plugged with weather-resistant material.
    e. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.
    f. Fabricate joints that will be exposed to weather in a watertight manner.
    g. Close exposed ends of handrail and railing members with prefabricated end fittings.
    h. Fasteners: Manufacturer's standard.

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 and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. 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 manufacturer.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Hatch Installation:

1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
2. Attach safety railing system to roof hatch curb.
3. Attach ladder safety post according to manufacturer's written instructions.

3.3 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 077200

SECTION 079200 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Latex joint sealants.
3. Acoustical joint sealants.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 07 Section "Expansion Control" for building expansion joints.
3. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
4. Division 08 Section "Glazing" for glazing sealants.
5. Division 09 Section "Gypsum Board" for sealing perimeter joints.
6. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. 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 formulation.
4. Joint-sealant color.

E. Qualification Data: For qualified Installer.

F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Field-Adhesion Test Reports: For each sealant application tested.

I. Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.4 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply

with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural 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 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Pecora Corporation; 890.
d. Tremco Incorporated.

B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.

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. Dow Corning Corporation; 790.

b. Pecora Corporation; 301 NS.
c. Tremco Incorporated; Spectrem 800.

C. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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. Pecora Corporation; 898.

2.3 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. May National Associates, Inc.; Bondaflex 600.
d. Pecora Corporation; AC-20+.
e. Schnee-Morehead, Inc.; SM 8200.
f. Tremco Incorporated; Tremflex 834.

2.4 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint 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.

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. Pecora Corporation; AC-20 FTR.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are 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), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application

indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

a. Concrete.
b. Masonry.
c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.
b. Glass.
c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, 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 recommendations.

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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints between cast stone units.
    b. Control and expansion joints in unit masonry.

c. Joints between different materials listed above.
d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
e. Control and expansion joints.
f. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Control and expansion joints in terrazzo flooring.

2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Vertical joints on exposed surfaces of interior unit masonry and walls.
e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
f. Other joints as indicated.

2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

    a. Acoustical joints where indicated.
    b. Other joints as indicated.

2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Habersham Metal Products Company.
5. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. 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 STANDARD HOLLOW METAL 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/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

        1) Locations: Exterior doors and interior doors where indicated.

3. Vertical Edges for Single-Acting Doors: Square edge.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.053-inch-thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.053-inch-thick steel sheet.
4. Frames for Wood Doors: 0.053-inch-thick steel sheet.
5. Frames for Borrowed Lights: 0.053-inch-thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

B. 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.

2.6 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 hollow metal frames, a minimum of 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.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Drip Caps: Welded flush drip caps at tops of exterior doors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal 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.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal 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: Weld flush face joints 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. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. 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) Three anchors per jamb from 60 to 90 inches high.
2) Four anchors per jamb from 90 to 120 inches high.
3) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Four anchors per jamb from 60 to 90 inches high.
2) Five anchors per jamb from 90 to 96 inches high.
3) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
4) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. 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.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work 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 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. 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 hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so 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 hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness 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 nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

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 because of 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 plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing 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: 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 grout.
5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
7. Installation Tolerances: Adjust hollow metal 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.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. 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 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 081416 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

D. Section 099123 - Interior Painting: Field finishing of doors.

1.3 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

C. ICC (IBC) - International Building Code; 2012.

D. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

G. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

H. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

I. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

J. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

K. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

L. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

M. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Specimen warranty.

D. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.

E. Samples: Submit two samples of door construction, 6 X 6 inch in size cut from top corner of door.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 1300, Premium Grade.

B. Finish door in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 150, Grades identified in schedule.

C. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.6 REGULATORY REQUIREMENTS

A. Fire Door Construction: Conform to NFPA 252.

1. Listed and classified by UL as suitable to and for the purpose specified and indicated.

B Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in

damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1. 8 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.9 WARRANTY

A. See Section 017700 - Closeout Procedures.

B. Provide manufacturer's warranty for the following term:

1 Interior Doors: Life of installation which shall include rehanging and refinishing.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:

1. Algoma.
2. Eggers Industries; www.eggersindustries.com.
3. Lambton Doors.
4. Marshfield DoorSystems, Inc; www.marshfielddoors.com.
5. Oshkosh Architectural Door Company.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 DOORS

A. Doors: Refer to drawings for locations and additional requirements.

1. Quality Level: Premium Grade with A grade veneer, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.

2. Fire-Rated Doors: Tested to 20 minutes, 60 minutes, 90 minutes, and ratings as indicated on drawings in accordance with UL 10C - Positive Pressure; UL (DIR) or ITS (DIR) labeled without any visible seals when door is open.

3. Lead Lined (X-ray) Doors: Minimum of 1/16 inch thick lead, unless otherwise indicated.

4. Wood veneer facing for field transparent finish as indicated on drawings.

2.3 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: AWI Architectural Woodwork Quality Standards Illustrated, Section 1300, Type PC-5 - Particleboard.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound Resistant Doors: Equivalent to type, with particleboard core (PC) construction with core as required to achieve STC rating specified; plies and faces as indicated above.

D. Lead Lined Doors: Equivalent to type, with bonded particleboard core (PC) with continuous lead sheet from edge to edge in the center of the core or between the crossband and the core; lead thickness; plies and faces as indicated above.

2.4 DOOR FACINGS

A. Interior Doors - Veneer: Premium grade wood veneer, Grade A, white birch, plain sliced, with slip matched grain, balance matched assembly, for transparent finish as listed in the finish schedule.

1. Face veneer and crossband shall be pressed to the core in a hot-press with Type I waterproof glue.

2.5 ACCESSORIES

A. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

B. Provide fire-rated frames at fire rated doors.

2.6 DOOR CONSTRUCTION

A. Cores Constructed with stiles and rails:

B. Fabricate doors in accordance with AWI Quality Standards, Section 1300 requirements.

C. Fabricate doors in accordance with UL requirements. Attach fire rating label to door.

D. Provide lock blocks at lock edge and top of door (for closer) for hardware reinforcement. Lock blocks and reinforcing for closers shall match door edge banding material.

E. Lead Lined Doors and finish shall match construction of doors specified herein. Provide fire labels where required.

F. Fit door edge trim to edge of stiles after applying veneer facing.

G. Bond edge banding to cores.

H. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

I. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

J. Provide edge clearances in accordance with the quality standard specified.

2.7 FACTORY FINISHING - WOOD VENEER DOORS

A. Factory finish doors in accordance with specified quality standard:

1. Transparent Finish: TR-6, transparent catalyzed polyurethane, Premium quality, 40 satin sheen. Include stain of doors as selected by the Architect.

B. Seal door top edge with color sealer to match door facing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Clearances:

1. Provide clearances of 1/8 inch at sides and top; lock edge shall have required bevel to clear frame. Provide at the bottom, for specific locations, the minimum adequate clearance of the finish floor coverings and/or thresholds, not to exceed 3/4 inch.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

3.3 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule appended to this section.

END OF SECTION

SECTION 083213 – SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. WORK INCLUDED: Furnish complete automatic aluminum door system, as specified, that has been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

B. RELATED WORK:

1. Concrete: Division 03, applicable sections.

2. Masonry: Division 04, applicable sections.

3. Thermal and Moisture Protection: Division 07, applicable sections.

4. Openings: Division 08, applicable sections.

5. Electrical: Division 26, applicable sections.

1.2 REFERENCES

A. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA) 101: Appendix Dissimilar Materials.

B. AMERICAN ASSOCIATION OF AUTOMATIC DOOR MANUFACTURERS (AAADM).

C. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA) 1303.5: Voluntary Specifications for Forced-Entry Resistant Aluminum Sliding Glass Doors.

D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):

1. ANSI Z97.1: Safety Glazing Materials Used in Buildings - Methods of Test.

2. ANSI A156.10 - 2011: For Power Operated Pedestrian Doors; Sliding Doors section.

3. ANSI A156.5: Standard for Auxiliary Locks and Associated Products

E. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM);

1. ASTM B221: Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.

F. BUILDING OFFICIALS AND CODE ADMINISTRATORS INTERNATIONAL (BOCA)

G. INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS / UNIFORM BUILDING CODE (ICBO/UBC)

H. INTERNATIONAL CODE COUNCIL / INTERNATIONAL BUILDING CODE (ICC/IBC)

I. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 101:

1. NFPA 101: Code for Safety to Life from Fire in Buildings & Structures.

2. NFPA 70: National Electrical Code (NEC).

J. THE ALUMINUM ASSOCIATION (AA) Aluminum Finishes Manual.

K. UNDERWRITERS LABORATORY, INC. (USA & CANADA) UL 325: Electrical Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.3 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer's complete product and installation data.

B. SHOP DRAWINGS: Submit drawings showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).

C. CLOSEOUT SUBMITTALS: Submit the following:

1. Owner’s Manual.

2. Warranty document as specified herein.

3. AAADM inspection compliance form completed and signed by certified AAADM inspector prior to doors being placed in operation as proof of compliance with ANSI A156.10 - 2011.

1.4 QUALITY ASSURANCE AND PERFORMANCE REQUIREMENTS

A. INSTALLERS QUALIFICATIONS: Installer shall be factory trained, certified by AAADM, and experienced to perform work of this section.

B. MANUFACTURER'S QUALIFICATIONS: Manufacturer to have minimum (5) five years successful experience in the fabrication of automatic doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

C. CERTIFICATIONS: Automatic sliding door systems and options shall be factory certified to meet performance design criteria in accordance with the following standards:

1. ANSI A156.10 - 2011: For Power Operated Pedestrian Doors; Sliding Doors section.

2. NFPA 101: Code for Safety to Life from Fire in Buildings & Structures.

3. UL 325: Electrical Door, Drapery, Gate, Louver, and Window Operators and Systems.

4. BOCA: Means of Egress, Power Operated Doors.

5. ICBO/UBC: Egress Through Lobbies.

6. ICC/IBC: Egress Section.

D. FORCED ENTRY RESISTANCE: Sliding doors shall meet requirement of AAMA 1303.5.

E. OPERATING RANGE: -30° F to 130° F (-34° C to 54° C).

F. OPENING FORCE REQUIREMENTS FOR EMERGENCY EGRESS:

1. Slide-swing panels shall require no more than 50 lbf. (222 N) of force to swing open. Slide-swing panels shall be capable of swinging out 90° from any position of slide movement.

2. Slide-swing panels and swing-out sidelites shall have torsion spring designed to re-close panel if pushed open in the direction of egress.

3. If power fails, slide panels can be manually slid open with no more than 15 lbf (222 N) of force.

4. Units are UL listed as an exit way and are compliant with NFPA 101.

G. CLOSING FORCE REQUIREMENTS: Maximum force required to prevent sliding panel from closing = 28 lbf. (124.5 N) Adjustable Reversing Circuit will reopen door unit if closing path is obstructed.

H. HEADER CAPACITY: Header shall be capable of supporting:

1. Biparting: Up to 300 lbs. (136 kg) per slide panel over spans up to 14’-0” (4280mm) without intermediate supports.

2. Single Slide: Up to 500 lbs. (227 kg) per slide panel over spans up to 9’-0” (2743mm) without intermediate supports.

1.5 WARRANTIES

A. MANUFACTURER'S WARRANTY: Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion.

Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.

B. DISTRIBUTOR'S WARRANTY: One year warranty: Labor & transportation charges for defective parts replacement.

1.6 PROJECT CONDITIONS

FIELD MEASUREMENTS: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.

1.7 DELIVERY, STORAGE AND HANDLING

A. ORDERING AND DELIVERY: Comply with factory's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.

B. STORAGE AND PROTECTION: Provide protection from exposure to harmful weather conditions and vandalism.

PART 2 – PRODUCTS

2.1 MANUFACTURER

HORTON AUTOMATICS, a division of Overhead Door Corporation, shall manufacture automatic sliding door(s) of type(s) and size(s) specified on plans and door schedule.

A. Interior Sliding Door:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Horton Automatics, "HD-Slide Series 2500 Elegant" door system, 1 3/4" -inch by 4 ½"-inch extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

2.2 EQUIPMENT

A. MANUFACTURED DOOR UNITS: Shall include operator, header with roller track, carrier assemblies, framing jambs, sliding door panel(s), sidelite(s), activation, safety devices and accessories required for complete installation.

1. Configuration: Single Slide or Biparting

2. Mounting Type: Perimeter mounted within rough opening with sliding panel(s) sliding along sidelite.

3. Door Type:

a. Type 010: Sliding panel(s) 'X' shall slide along interior side.
b. Type 110: Slide-swing panel(s) 'SX' shall slide along exterior side.
c. Type 310: Slide-swing panel(s) 'SX' shall slide along interior side. Unit has Swing-out sidelite 'SO'.

B. OPERATOR: The Electric Operating Mechanism shall be HD-Slide® Series 2001 Belt Drive. Maximum current draw shall not exceed 3.15 amps. The heavy duty operator shall be mounted and concealed within the header.

1. Operating force shall be accomplished through a 1/8 HP DC permanent magnet motor with heavy duty worm gear transmission and 1800 RPM working with reinforced drive belt, attached 1/4" thick steel door hangers, and idler pulley (1/4 HP motor required for door panels weighing 500 lbs). Drive belt to be steel reinforced nylon, 1" (25.4 mm) wide. Idler pulley to be reinforced, metallic material.

2. Master Control shall be 16 bit microprocessor controller with dual on-board seven-segment alphanumeric diagnostic display and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. The control shall have minimum of 28 programmable parameters including the following functions as required by ANSI A156.10 - 2011:

    a. Adjustable opening and closing speeds.
    b. Adjustable back-check and latching.
    c. Adjustable braking.
    d. Adjustable hold-open time between 1 to 30 seconds.
    e. Adjustable Reversing Circuit will reopen door unit if closing path is obstructed.
    f. Separate day and night modes of operation with security over-ride.

3. Finger Safety: When unit slides open, strike rail of sliding panel will stop short of adjacent sidelite; resulting opening is net slide.

4. On/Off Switch shall be supplied. When switched OFF, unit reverts to free manual operation (likewise during electrical power failure).

C. SECURITY AND SAFETY POWER FAIL OPTIONS:

1. Automatic lock: Automatically locks slide function of door when in closed position. Additional power supply for autolock not acceptable.

    a. Autolock Fail Secure: If power fails the lock engages.
    b. Autolock Fail Safe: If power fails the lock disengages.

2. Monitored Power Fail Options (battery back-up):

    a. Software Selectable Power Fail Open: If power fails the door slides open.
    b. Software Selectable Power Fail Close: If power fails the door slides closed.

D. HD-SLIDE® HEADER: Shall be 6" (152 mm) deep by 8" (203 mm) high, heavy duty aluminum construction with removable face plate and extruded support brackets for dead load and lateral strength.

E. CARRIER ASSEMBLIES AND HEADER ROLLER TRACK: Carrier assemblies shall support door panels with minimum four rollers per panel. Rollers will be non-metallic high quality ball bearing wheels 2" (51 mm) diameter. Anti-Derailing shall be accomplished by means of a

continuous aluminum extrusion full length of slide panel travel. Overhead header roller track shall be continuous aluminum and replaceable.

F. SLIDING PANEL(S) AND SIDELITE(S): Shall be 1/2" (13 mm) thick tempered glass with polished vertical edges mounted in top and bottom horizontal aluminum rails. Weather-stripping retained in top and bottom rails and in clear acrylic extrusions mounted along vertical edges of sliding glass panel.
   1. Optional extra wide fixed sidelite(s) of size and type indicated.
   2. Optional Recessed sidelite and track and non-threshold application.

G. BREAKOUT PANELS: Slide-swing panels can swing out 90° from any position of slide movement and require no more than 50 lbf. (222 N) of force applied at the lock stile to open. Slide-swing panels shall utilize spring loaded ball detent.
   1. Slide-swing panels and swing-out sidelites shall have torsion spring designed to re-close panel if pushed open in the direction of egress.
   2. Breakout mechanism shall provide support across full width of the door, in normal operating mode. In breakout mode, torsion assembly shall support weight of the door to minimize drop during emergency egress.
   3. Units with breakout feature are UL listed as an exit away and are compliant with NFPA 101.

H. JAMBS/FRAME: Shall be aluminum. Jamb dimensions to be 1 3/4" (44mm) deep by 4 1/2" (114mm) wide. Optional 6" (152mm) wide with maximum height: 8’-8. Optional transom of size and type indicated, mounted on header.

I. THRESHOLD: Shall be aluminum, 1/2" (25 mm) tall by 4” (102 mm) wide. Optional 7” (178 mm) wide.

J. HARDWARE: Provided and installed in bottom rail shall be Maximum Security Lock with 31/32" (25 mm) backset and Two-point keyed 1 5/32" (29 mm) standard size cylinder. Deadlock dropbolt into threshold.

2.3 RELATED EQUIPMENT

BASIC SENSOR SYSTEM: Shall be 24 VDC, class ll circuit and shall be adjusted and installed in compliance with ANSI A156.10. System shall include the following:

A. ACTIVATION SENSORS: Microwave or active infrared sensor shall be header-mounted each side of door unit for detection of traffic from each direction.

B. THRESHOLD PRESENCE SENSORS:

1. Header mounted sensors shall provide active infrared presence detection on each side of the door unit and shall remain active throughout the entire door opening and closing cycle.
2. Hold-open beams: Two pulsed infrared photoelectric beams to be mounted in vertical rails of sidelite or in jambs. Sender/receiver arrangement parallels door opening.

2.4 RELATED WORK REQUIREMENTS

A. ELECTRICAL: 120 VAC, 50/60 cycle, single phase, dedicated 20 amp circuit per operator. Non-North American voltages can be 240 VAC 50/60 cycle (operator must have 240 volt power supply).

B. GLASS AND GLAZING: Glass stops, glazing vinyl and setting blocks for field glazing as per Safety Glazing standard ANSI Z97.1.2. Contractor to coordinate acquisition of glass in thickness and type in accordance with manufacturer's recommendations for prescribed design.

2.5 MATERIALS, FINISHES AND FABRICATION

A. EXTRUDED ALUMINUM: ASTM B221, 6063-T5 alloy and temper, anodized:

1. Structural Header Sections: Minimum 3/16" (5 mm) thickness.

2. Structural Frame Sections: Minimum 1/8" (3 mm) thickness.

3. Structural Panel Sections: Commercial grade.

B. FINISHES (for all exposed aluminum surfaces): Shall be:

1. 204-R1 Clear: Arch. Class 2 Clear Anodized Coating, AA-MI2C22A31.

C. FRAME CONSTRUCTION: Butt joints, mechanically secured with screws and formed alum. corner brackets.

D. OPERATOR CONSTRUCTION: Electromechanical, modular type construction.

PART 3 – EXECUTION

3.1 EXAMINATION

SITE VERIFICATION OF CONDITIONS: Installer must verify that base conditions previously installed under other sections are acceptable for product installation according to with manufacturer's instructions. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not start work until all negative conditions are corrected in a manner acceptable to the installer and manufacturer.

3.2 INSTALLATION

A. GENERAL: Installer shall be factory trained, certified by AAADM, and experienced to perform work of this section. Install door units plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.

B. DISSIMILAR MATERIALS: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

C. WEATHER-TIGHT CONSTRUCTION: Install header and framing members in a bed of sealant or with joint filler or gaskets. Coordinate installation with wall flashings and other components of construction.

D. ELECTRICAL: General or electrical contractor to install all wiring to operator on a separate circuit breaker routed into header. General or electrical contractor also to install all necessary power and low voltage wiring for proper operation of associated security systems.

3.3 CLEANING, ADJUSTMENT AND PROTECTION

A. CLEANING: After installation, installer to take following steps:

1. Remove temporary coverings and protection of adjacent work areas.

2. Remove construction debris from construction site and legally dispose of debris.

3. Repair or replace damaged installed products.

4. Clean product surfaces and lubricate operating equipment for optimum condition and safety.

B. ADJUSTMENT: AAADM certified technician to inspect and adjust installation. Comply with ANSI A156.10-2011.

C. ADVISE CONTRACTOR: Of precautions required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of acceptance.

Note: Horton Automatics reserves the right to make product improvements and change specifications without notice.

END OF SECTION

SECTION 084113 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior and interior storefront framing.
   2. Exterior manual-swing entrance doors.

B. Related Sections:
   1. Division 08 Section "Finish Hardware" for hardware to the extent not specified in this Section.
   2. Division 08 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems and sun control devices shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Glazing-to-glazing contact.
      e. Noise or vibration created by wind and by thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Sealant failure.
      h. Failure of operating units.

B. Structural Loads:
   1. Wind Loads: As indicated on the Structural Drawings.
   2. Seismic Loads: As indicated on the Structural Drawings.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches 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 L/360 of clear span or 1/8 inch, whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   1. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
   3. Interior Ambient-Air Temperature: 75 deg F.

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

K. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. Sound Transmission Class (STC): Minimum 32 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

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 for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
   2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
   3. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For units with factory-applied color finishes, to be provided from manufacturer’s full range.

D. Operation and Maintenance Data

E. Warranties: Sample of special warranties.

F. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

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 systems' 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 preconstruction testing, field testing, and in-service performance.
   1. Do not revise 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.

D. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports, and existing walls for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems 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: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Exterior Storefront System:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer, “Trifab 451UT” system, 2-inch by 4-1/2-inch thermally broken, extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads, or comparable product by one of the following:
   2.
      a. EFCO Corporation.
      b. Kawneer North America; an Alcoa company.
      c. YKK AP America Inc.

d. United States Aluminum

B. Interior Storefront System:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer, “Trifab 400” system, 1 3/4" -inch by 4-inch extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads, or comparable product by one of the following:
2.
a. EFCO Corporation.
b. Kawneer North America; an Alcoa company.
c. YKK AP America Inc.
d. United States Aluminum

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
6. Service Window Frames: 4” Aluminum Frame modules constructed of 6063-T5 extruded aluminum. Window glides on top-hung heavy-duty ball bearing slides. Poly-pile weather stripping and self-latching handle. Aluminum to be clear anodized. Color to be selected by Architect from manufacturer’s full range.
a. Glazing: ½” Tempered
b. Options: Keyed Lock, Full bottom Track

B. 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.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Exterior Storefront System
1. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
a. Construction: Thermally broken.
b. Glazing Plane: Front.

B. Interior Storefront System

1. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   a. Construction: Nonthermal.
   b. Glazing Plane: Center.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Extensions: Mullion clip extensions: 12” horizontal and vertical.

E. 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.

F. 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.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Manufacturer's extruded aluminum flashing with end dams.

H. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Door Construction: 2 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: Kawneer, 350, or equal by one of the specified manufacturers, Medium stile; 6 inch nominal width.

a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Section 087100 "Door Hardware."

2.6 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using shear-block system.

E. 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.

F. 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.

G. 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.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and 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.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 SOURCE QUALITY CONTROL

A. Obtain Exterior Storefront Framing System and Interior Storefront Framing System from one manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, 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.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by 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 to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 088000 "Glazing."

G. 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 Door Hardware: Install surface-mounted door hardware according to door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

I. Exterior Sun Control Devices
1. Units shall be factory-assembled and finished to the greatest extent possible.
2. Install in accordance with reference standards.
3. Device frames shall be installed with continuous bead of flashing cement under attachment to building structure.
4. Touch up finish. Complete finishing of structural steel tabs in accordance with Division 09 Section “Painting”. Paint bolts and other exposed connectors to match sun control devices.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 084413 – GLAZED ALUMINUM CURTAIN WALLS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes conventionally glazed aluminum curtain walls installed as stick assemblies.

B. Related Sections:
1. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
2. 084113 “Aluminum-Framed Entrances and Storefronts” for storefront and entrance systems.
3. Section 088000 “Glazing for glass installed in curtain walls.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings 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.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

D. Structural-Test Performance: 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, and 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.

E. 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 L/175 of the glass edge length for each individual glazing lite 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 L/360 of clear span or 1/8 inch, whichever is smaller.

F. Story Drift: Accommodate design displacement of adjacent stories indicated.
   1. Design Displacement: As indicated on Drawings.
   2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at 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. 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.

I. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
   1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   3. Thermal Transmittance (U-factor): Fixed glazing at doors shall have U-factor of not more than 0.77 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
   3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC- certified condensation resistance rating of no less than 68 as determined according to NFRC 500.

J. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. Outdoor-Indoor Transmission Class: Minimum 30 when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.

C. Shop Drawings: For glazed aluminum curtain walls. 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.

2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.
   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.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

F. Delegated-Design Submittal: For glazed 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 qualified Installer.

B. Welding certificates.

C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

E. Field quality-control reports.

F. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain

walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

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 revise 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.

D. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

E. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

F. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.

   2. Warranty Period: Two years from date of Owner’s acceptance.

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. 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. Warranty Period: 20 years from date of Owner's acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America Outside Glazed 1600 Wall System 1 with 2-1/2 inch by 7-1/2-inch thermal framing system designed to flush glaze insulating glass, or comparable product by one of the following:
1. EFCO Corporation.
2. Kawneer North America; an Alcoa company.
3. TRACO.
4. Tubelite.
5. United States Aluminum.
6. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
7. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. 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.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally improved, thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.

B. Snap-On Covers: Manufacturer's extruded-aluminum snap-on covers for vertical installation, of thickness required, and with end caps:

1. Provide snap-on covers of size and shape indicated on Drawings.
2. Finish shall match curtain wall finish.

C. Window Sills: Aluminum, as indicated.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. 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.

F. 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.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Framing Sealants: Manufacturer's standard sealants.

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.
1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 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.

2.6 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. Fabricate components that, when assembled, have the following characteristics:
   1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using screw-spline system.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Gloss: Color to be selected from manufacturer’s full range of color.

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.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

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 to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements as selected by Architect and qualified independent testing and inspection agency.
1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressuredifferential of 6.24 lbf/sq. ft.
   a. Test Area: One bay wide, but not less than 30 feet, by one story of glazed aluminum curtain wall.
   b. Perform a minimum of three tests in areas as directed by Architect.

c. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
   a. Test Area: One bay wide, but not less than 30 feet, by one story of glazed aluminum curtain wall.
   b. Perform a minimum of three tests in areas as directed by Architect.
   c. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
3. 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. Test Area: A minimum area of 75 feet by one story of glazed aluminum curtain wall.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. Commissioning: Field quality control of these systems is a part of building envelope commissioning. Refer to Section 019115 "Facilities Exterior Enclosure Commissioning" for requirements in addition to those listed above.

END OF SECTION 08 4413

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Lock cylinders for doors that hardware is specified in other sections.

D. Thresholds.

E. Weatherstripping, seals and door gaskets.

1.2 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 081416 - Flush Wood Doors.

1.3 PRICE AND PAYMENT PROCEDURES

A. See Section 012100 - Allowances, for allowances affecting this section.

1.4 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.

C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

D. BHMA A156.3 - American National Standard for Exit Devices; 2014.

E. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.

F. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.

G. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

H. DHI A115W Series - Specifications for Wood Door and Frame Preparation for Hardware; Door and Hardware Institute.

I. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute.

J. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Wood Flush Doors; Door and Hardware Institute.

K. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.

L. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association.

M. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

B. International Building Code with North Carolina Amendments - Latest Edition.

C. Americans With Disabilities Act - Latest Edition.

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Hardware Schedule: The hardware supplier shall submit a detailed hardware schedule showing doors and indicating the type of swing, key side, room to and from, the degrees of swing, the type of door buck, any special hardware locations, and a list of the hardware and manufacturers of each item. This schedule shall also show the recommended keying arrangement which shall be submitted through the General Contractor to the Architect for approval. Schedule shall include a consecutive listing of doors (numbered in sequence as shown on the Architectural Drawings) showing hardware for each door. Along with the Finish hardware Schedule, provide catalogue cuts of all items submitted as well as catalogue cuts of the specified items. If ANSI products or generic items are specified, the scheduled items will be cross referenced. Provide samples when requested.

1.7 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Perform work in accordance with the following requirements:

1. NFPA 101

2. NFPA 80

3. NFPA 252

C. The hardware supplier shall be one having in his regular employ, a builder's hardware consultant who is, through experience, capable of supervising the furnishing and installation of the hardware requirements contained herein. The consultant shall be available for technical assistance on the site that may be required in connection with hardware installation.

D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

E. Service: The project shall be visited by a representative of the hardware supplier, during the course of construction. One time shall be after all hardware is applied. The supplier must write a letter to the Architect after this visit and state his findings.

F. All hardware shall be installed by the installer or a Certified Installer, not by the Contractor's own forces.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements applicable to fire rated doors and frames.

B. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

D. All hardware furnished in connection with doors bearing labels or where necessary to meet special requirements, such as handicap codes, will be in strict accordance with conditions established by the authority having jurisdiction and subject to approval of that authority as specified herein.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.10 COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

B. Furnish templates for door and frame preparation.

C. Coordinate Owner's keying requirements during the course of the Work.

1.11 WARRANTY

A. See Section 017700 - Closeout Procedures, for additional warranty requirements.

B. Provide five year warranty for door closers and _____.

1.12 MAINTENANCE PRODUCTS

A. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 – PRODUCTS

2.1 MANUFACTURERS - BASIS OF DESIGN

A. _____.

B. _____.

C. Locks, Latches, Bolts: Corbin/Russwin

D. Push/Pulls: Hager, Ives, Rockwood

E. Push / Pull Latches (HL-6): Hager, Trimco

F. Electric Strikes: Von Duprin, HES

G. Exit Devices: Von Duprin, 99 series

H. Closers: LCN, Norton

I. Stops, Strikes, Holders: Hager, Ives, Rockwood

J. Programmable Locking System (Punch Lock): Locknetics

K. Protection Plates: Hager, Ives, Rockwood

2.2 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.

1. If no hardware set is indicated for a swinging door provide an office lockset.

2. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.

3. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer’s standard tumbler type, six-pin standard core.

1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Grand master keyed.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.3 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Interior door butts, stops, holders and miscellaneous items shall be US26D whenever possible.

B. Exterior door butts, locksets and trim, door pulls, push plates shall be US32D.

2.4 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:

1. Applicable provisions of Federal, State, and local codes.

2. Applicable provisions of NFPA 101, Life Safety Code.

3. Fire-Rated Doors: NFPA 80.

4. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Finishes: Identified in schedule at end of section.

C. Butt Hinges:

1. In general, provide 1-1/2 pair per door of average height. For doors under 5', one pair will suffice. Doors over 90" in height shall have (2) two pair. Dutch doors shall have a minimum of two pair.

2. All hinges shall be 5 knuckle and have flat button tips unless specified otherwise.

3. Hinge size shall be 4-1/2 x 4-1/2, .134 gauge for new doors up to and including 36" wide. Doors over 37" wide and less than 42" shall have 5" x 4-1/2" .146 gauge scheduled. Doors over 42" shall have 5" x 4-1/2" 4 ball bearing hinge .190 gauge.

4. Hinges shall be full mortise type generally. Hinges for labeled doors shall meet requirements of NFPA-80.

5. Exterior outswinging doors shall have 4 bearing .190 gauge hinges sized as paragraph 3 above in brass, bronze, or stainless steel. Stainless shall be scheduled unless finish dictates otherwise.

6. Interior doors shall have steel hinges scheduled.

7. Provide ball or oilite bearing hinges on all doors with closers and on all metal doors, and on doors over 37" wide and all high frequency openings. Other doors shall be plain bearing.

8. Provide hinges with non-removable pins and/or security studs for all outswing exterior doors and high security interior controlled doors.

9. Half-surface thru-bolted hinges shall be provided at “B” label 1 and 1-1/2 hour rated wood doors unless manufacturer guarantees full mortise installation because of special reinforcing provisions.

10. Half mortise or full surface hinges.

11. Provide mortised pivots at lead-lined doors.

12. Use wide-throw hinges in locations where it is required. Swing clear hinges shall be scheduled by the Architect.

13. Continuous Hinges shall be used at High Traffic areas (pair of wood doors and double egress doors.

D. Locksets:

1. All locks scheduled shall be products of the same manufacturer.

2. Latchsets shall be mortise type series ML2000HS, with lever handles (Lustra) to comply with ADA requirements. Provide knurled grip as required.

3. Whenever a dead bolt function is specified, the bolt throw shall be 1" min.

4. Latch bolt throw on exterior doors shall be 5/8" or 3/4".

5. All cylinders shall be 7-pin.

E. Exit Devices:

1. Where exit devices are used in a door where the device spans across a vision panel, the device shall be equipped with appropriate sized rods to mount the exit device below the vision panel.

2. Provide surface mounted rods.

3. Push pad devices shall be patterned punched to designate code requirements where required.

F. Door Closers:

1. Closers shall be mounted on the room side of the door.

2. Doors shall be equipped with top jamb mounted closers on drop brackets if overhead holders are specified. Otherwise closers shall be parallel arm mounted with arm stops.

3. A standard of quality shall be established with LCN, Model 4010/4110, Cush-N-Stop.

G. Door Holders: When floor and/or wall stops are not appropriate, overhead holders shall be scheduled.

H. Door Stops:

1. Door stops shall be installed wherever an open door or any item of hardware thereon strikes a wall or other part of building construction. Where the wall stop cannot be used effectively, install a floor stop. At drywall condition, use floor stops. Use carpet riser as required. Other stops shall be installed with proper blocking within the wall.

I. Protection Plates:

1. Protection Plates shall be color core laminate or .050 gauge metal as determined by finish section. Plates shall be beveled 4 sides and attached by countersunk sheet metal oval screws.

2. Kick/mop plates shall be 6" high.

a. Armor plates shall be 42" high.

3. Width shall be 1-1/2" LDW for single doors on push side. 1" LDW on pull side and at pairs of doors.

4. Protection plates located on rated doors shall comply with the requirements of NFPA 80.

J. Door Bolts:

1. Automatic flush bolts shall be used only on A label doors or where required by code. Flush bolts shall be as manufactured by Baldwin, Ives, Rockwood, Quality, Hager or Trimco. Flush bolts for B label doors and under shall be self-latching type.

2. All flush bolts, unless locked into a threshold, shall be provided with a dust proof strike.

K. Coordinators:Coordinators shall only be used at all label pairs of doors requiring the use of an astragal, except at double egress doors.

L. Rain Drip: When exterior doors are not protected by building roof and conditions dictate, provide rain drip 4" wider than door size. Products of equal design, finish, and function manufactured by Baldwin, Ives, Rockwood, Quality, or Trimco will be considered equal.

M. Thresholds: Shall be aluminum for water resistant applications. Concealed door closers shall have covers which match thresholds. Products of equal design, finish, and function manufactured by Baldwin, Ives, Rockwood, Quality, or Trimco will be considered equal. Provide carpet divider fire stop thresholds at all rated doors where carpet extends through the door opening.

N. Weatherstrip: All exterior doors shall be equipped with weatherstripping. Provide door sweep when flat thresholds are detailed. Products of equal design, finish, and function manufactured by Baldwin, Ives, Rockwood, Quality, or Trimco will be considered equal.

O. Light Seal and Automatic Door Bottoms: Light seal and automatic door bottoms shall be as scheduled in the remarks column of the door schedule.

P. Astragals: Provide and install steel astragals at all double egress doors and pairs of rated doors.

2.5 KEYING

A. Door Locks: Grand master keyed.

1. Include construction keying. Provide cylinders with feature that permits voiding construction keys without cylinder removal.

2. Key to existing keying system.

B. Supply keys in the following quantities:

1. 10 master keys.

2. 3 grand master keys.

3. 10 construction keys.

4. 3 change keys for each lock.

5. All keys shall be stamped "DO NOT DUPLICATE."

2.6 KEY CABINET

A. Cabinet Construction: Sheet steel construction, piano hinged door with type lock master keyed to building system.

B. Cabinet Size: Size for project keys plus 50 percent growth.

C. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage and progressive-type ball bearing suspension slides; Include single cylinder lock to all drawers. Provide key-gathering envelopes and two sets of key tags.

D. Cross-Index System: Set up key control manufacturer, complying with the following:

1. Computer software: Furnish cross-index software for recording and reporting key-holder listings, tracking keys and lock & key history. Include instruction manual.

E. Horizontal metal strips for key hook labelling with clear plastic strip cover over labels.

F. Finish: Baked enamel, white color.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item.

1. For steel doors and frames: Comply with DHI (LOCS) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".

2. For Wood Doors: Comply with DHI WDHS.3 "Recommended Locations for Architectural Hardware for Flush Wood Doors".

E. Set units level, plumb and true to line and location, adjust and reinforce the attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units which are not factory installed, prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

G. Cut and fit threshold covers to profile of door frames with mitered corners and hair line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindels, bolts and similar items.

H. Drill and countersink units which are not factory installed, prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.3 ADJUSTING

A. Adjust work under provisions of Section 017300 and 017700 - Execution and Closeout Procedures.

B. Adjust hardware for smooth operation.

3.4 CLEANING

A. It shall be the Contractor's responsibility to adjust and check each operating item of hardware and each door, to insure proper operation of function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer. (Graphite type if no other recommended). Replace units which cannot be adjusted and lubricate to operate freely and smoothly as intended for the application mode.

B. Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Instruct Owner's personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

3.5 CONTINUED MAINTENANCE SERVICE

A. Approximately six months after the acceptance of hardware in each are, the installer, accompanied by the Contractor and the hardware supplier shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Provide Architect with a written report upon completion of the above.

3.6 COMPLETION

A. Inspection of Hardware and Installation:

1. The hardware supplier shall visit the Project when the hardware is delivered and check it before it is installed. He shall visit the Project again after all the hardware has been installed and shall notify the Architect, in writing, if there is any hardware that is not functioning properly or has not been installed or adjusted correctly.

2. The Contractor shall turn over to the Owner, in book form, after completion of the Work, at least one copy of every installation instruction sheet and parts list, all tools, wrenches and templates, that come packaged with the hardware, for the Owner’s use in servicing the hardware.

3.7 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 088000 – GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for windows, doors, interior borrowed lites, storefront,and framing glazed curtain walls.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) 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. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 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. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:

1. AGC Glass Company North America, Inc.
2. Cardinal Glass Industries.
3. Cristacurva.
4. Dlubak Corporation.
5. Gardner Glass, Inc.
6. GGI; General Glass International.
7. Glasswerks LA, Inc.
8. GTI; Glaz-Tech Industries.
9. Guardian Industries Corp.; SunGuard.
10. Hartung Glass Industries.
11. JE Berkowitz, LP.
12. Northwestern Industries, Inc.
13. Oldcastle BuildingEnvelope?.
14. Pilkington North America.
15. PPG Industries, Inc.
16. Schott North America, Inc.
17. Tecnoglass.
18. Trulite Glass & Aluminum Solutions, LLC.
19. Vetrotech Saint-Gobain.
20. Viracon, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
4. 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. 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 (W/sq. m x K).
2. 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.
3. 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. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
2. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
3. 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. 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.

B. Heat-Treated Float Glass, Heat Strengthened: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

C. Heat-Treated Float Glass: Fully Tempered: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT, of class and condition indicated, CPSC 16CFR-1201; ANSI Z 97.1, where safety glass is indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).
4. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
5. Products: Subject to compliance with requirements, provide **Guardian Industries**, or comparable product from the following:

    a. AFG Industries, Inc.
    b. Cardinal Glass Industries
    c. PPG Industries
    d. Pilkington

D. Ceramic-Coated Vision Glass: ASTM C 1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual."

1. Basis-of-Design Product: provide **Guardian Industries**, or comparable product from the following:

    a. AFG Industries, Inc.
    b. Cardinal Glass Industries
    c. PPG Industries

d. Pilkington

2.5 INSULATING GLASS

A. **Glass Type 1:** Basis of Design Product: Subject to compliance with requirements, provide the following for Solar Control Low-E Insulating Glass:

1. Low-e-coated, clear insulating glass. Basis-of-Design Guardian Sunguard SNR 43

   a. Overall Unit Thickness: 1 inch.
   b. Thickness of Each Glass Lite: 6.0 mm.
   c. Outdoor Lite: Fully tempered float glass.
   d. Interspace Content: Air.
   e. Indoor Lite: Fully tempered float glass.
   f. Low-E Coating: Sputtered on second surface.
   g. Visible Light Transmittance: 43 percent minimum.
   h. Winter Nighttime U-Factor: 0.29 maximum.
   i. Summer Daytime U-Factor: 0.27 maximum.
   j. Solar Heat Gain Coefficient: 0.23 maximum.
   k. Provide safety glazing labeling.

2. Other Manufacturers:
   a. Arnold Glass, Corp.
   b. PPG Industries Walker Textures AviProtek
   c. Viracon
   d. Pilkington

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.
4. Provide Low-E vacuum deposition-coated glass with coating on surface 2.
5. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
6. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
7. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

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.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

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.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended 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.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do 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.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glass mirrors.

1.2 REFERENCE STANDARDS

A. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.3 PERFORMANCE REQUIREMENTS

A. Limit mirrored glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.5 QUALITY ASSURANCE

A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS).

1.6 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

A. See Section 017700 - Closeout Procedures.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass : Clear float type with copper and silver coating, organic overcoating, arrised edges, 1/4 inch thick minimum.

1. Size: As noted on drawings.

2.3 ACCESSORIES

A. Mirror Attachment Accessories: Stainless steel J-profile channels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

3.3 INSTALLATION

A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors with clips, and anchor rigidly to wall construction.

3.4 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Clean mirrors and adjacent surfaces.

END OF SECTION

SECTION 092116 – GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal stud wall framing.
B. Metal channel ceiling framing.
C. Shaft wall system.
D. Acoustic insulation.
E. Gypsum wallboard.
F. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 061000 – Rough Carpentry for wood blocking and support of wall-mounted equipment.

B. Section 079200 - Joint Sealants.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014a.

J. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

L. ASTM E413 - Classification for Rating Sound Insulation; 2016.

M. GA-216 - Application and Finishing of Gypsum Board; 2013.

1.4 SYSTEM DESCRIPTION

A. Acoustic Attenuation for Interior Partitions shown to have sound attenuation blankets : STC of 45-49 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

B. Shaft Wall: Configure and install components as required to achieve the following performance levels:

1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.

1.5 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.6 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups to demonstrate aesthetic effects and 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 Owner's acceptance.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned to maintain relative humidity in the space at or below 70 percent.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.2 MANUFACTURERS

A. Gypsum Board:

1. G-P Gypsum Corporation: www.gp.com.
2. National Gypsum Company: www.nationalgypsum.com.
3. USG Corporation: www.usg.com.
4. Substitutions: See Section 012500 – Substitution Procedures.

B. Metal Framing:

1. Clark Steel Framing Systems: www.clarksteel.com.
2. Dale/Incor: www.daleincor.com.
3. Dietrich Metal Framing, Inc : www.dietrichindustries.com.
4. Marino-Ware: www.marinoware.com.
5. Substitutions: See Section 012500 – Substitution Procedures.

2.3 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and gauge to comply with ASTM C 754 at the spacing indicated, with maximum deflection of L/240 at 5 psf. All interior light gage stud wall systems shall be designed and finished for compliance with the code defining loading (live load = 5 psi min. horizontal) plus hung equipment loadings. Design of a wall system shall be done utilizing the light gage metal stud properties only. Composite wall construction properties utilizing gypsum board panels may not be considered.

1. Studs: C shaped with knurled faces.
2. Runners: U shaped, sized to match studs.

3. Ceiling Channels: C shaped.
4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.

2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.

E. BOARD MATERIALS

1. Manufacturers: products are based on Georgia-Pacific Gypsum Corp.

2. Gypsum Wallboard: Sizes to minimize joints in place.

a. Regular Type: DensArmor Plus Fireguard

1) Application: Use for Interior face of the exterior wall, unless otherwise indicated, level 4 finish minimum.
2) Core Type: Type X
3) Thickness: 5/8 inch.
4) Edges: Tapered.

b. Regular Type: Tough Rock Mold Guard

1) Application: Typical use for all locations for vertical and ceiling locations, unless otherwise indicated.
2) Core Type: Type X
3) Thickness: 5/8 inch.
4) Edges: Tapered.

3. Water-Resistant Gypsum Backing Board: DensArmor Plus Fireguard. ASTM C 1396/C 1396M; ends square cut. Level 4 finish Minimum.

a. Application: Install behind all plumbing fixtures and toilet rooms and ceiling in showers. Behind all plumbing fixtures provide a minimum of 2'-0" centered on the fixture horizontally and on both sides of the wet wall.
b. Core Type: Type X.
c. Thickness: 5/8 inch.
d. Edges: Tapered.

F. FIBERGLASS FACED BOARD MATERIALS

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

2.4 ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch.

B. Acoustic Sealant: As specified in Section 07 90 05.

C. Corner Beads: Galvanized steel.

D. Edge Trim: Bead type(s) as detailed.

E. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project.

F. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.

2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.

2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.3 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated or if not indicated as follows:

1. Wire: Hanger wire shall be anchored securely to structural steel frame, or to approved anchors in concrete slabs. Space hangers not over 4 feet O.C. in direction of main runner channels, and as specified for runner spacing at right angels to main runners. Provide hanger within 6 inches of ends of main runner runs and of boundary walls, girders or similar interruption of ceiling continuity.

2. Main Runners: Main runners shall be properly positioned and leveled, and hangers shall be saddle-tied along runner. Place main runners not over 4 feet O.C. Hangers shall be attached directly to building structural system and/or floor or roof deck above. In no case will hanging from building mechanical systems, ducts, piping, conduit, etc., be permitted. Where interference from building systems does not permit proper attachment of hangers to building, provide bridging under such items to support hangers at proper spacing. For spaces up to 5 feet, use 2 inch cold rolled channels as bridging; for spaces over 5 feet, use 20 gauge metal studs sized as appropriate for the required space.

3. Level ceiling system to a tolerance of 1/600.

4 Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.

1. Extend partition framing to structure where indicated and to 6" above ceiling in other locations unless otherwise indicated on the drawings..

2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Special Framing:

1. Locate studs no more than 2 inches from all door frame jambs, abutting partitions,

partition corners, and other construction.

2. Anchor studs securely to jamb and head anchor clips of each door or borrowed light frame by bolt or screw attachment.

3. Double-up 20 gauge studs, back to back at all door jambs and either side of door frame and window frame combinations.

4. Strap anchor studs together with a minimum of three per jamb.

5. Where electrical panels or plumbing soil pipe hubs are located in partitions exposed both sides, use appropriate stud size for partition framing.

6. Where electrical panels, medical gas boxes, back to back medical headwall units, nurse call boxes, plumbing fixtures using carriers, uninsulated piping in excess of 3" or 1-1/2" insulated piping are located in partitions exposed on both sides, use 6" studs for the partition. This framing method shall extend from perpendicular wall to perpendicular wall. If 6" studs are inadequate, double-up wall width.

7. Provide 20 gauge studs of size indicated on the Drawings on all walls where ceramic tile is the finish, where any non-self supporting wall hung fixtures, equipment, or cabinetry occurs, and where otherwise indicated on the Drawings.

3.4 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.5 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board vertically, with ends and edges occurring over firm bearing.

C. Double-Layer Installation: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.

D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive

lamination.

E. Installation of Gypsum Board Above Ceilings:

1. Provide gypsum board on both faces of steel stud partition framing above ceilings and in similar concealed spaces as scheduled or as required by governing building codes for all fire rated partitions, and toilet rooms.

2. Seal joints with regular tape and compound. Carry gypsum board tight against structure or deck and seal. Gypsum board shall be cut to closely follow the configuration of the deck and sealed.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.6 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.7 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive eggshell paint finish or wall coverings, unless otherwise indicated.

2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.

3. Level 3: Walls to receive textured wall finish.

4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.8 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 095113 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.3 SUBMITTALS

A. See Section 013300 - For submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner.

1.4 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.5 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

1.6 EXTRA MATERIALS

A. Provide one box of each type of acoustical unit for Owner's use in maintenance of project.

PART 2 - PRODUCTS

2.1 ACOUSTICAL UNITS

A. Manufacturers:

1. Armstrong World Industries, Inc: www.armstrong.com.

2. CertainTeed Corporation: www.certainteed.com.

3. USG: www.usg.com.

4. Substitutions: See Section 012500 – Substitution Procedures.

B. Acoustical Units - General: ASTM E1264, Class A.

1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.

C. Acoustical Tile: See Finish Schedule.

D. Acoustical Panels Type: As indicated on the drawings.

1. Size: 24 by 24 inches.

2.2 SUSPENSION SYSTEM(S)

A. Manufacturers:

1. Armstrong World Industries, Inc: www.armstrong.com.

2. Chicago Metallic Corporation: www.chicagometallic.com.

3. USG: www.usg.com.

4. Substitutions: See Section 012500 – Substitution Procedures.

B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System: Formed hot-dipped galvanized steel, commercial quality cold rolled with painted finish; heavy-duty.

1. Profile: Tee; 15/16 inch and 9/16" wide face.

2. Construction: Double web.

3. Finish: White painted.

4. Product: See Finish Schedule; by Armstrong.

2.3 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Insulation: ASTM C665, friction fit type, unfaced batts.

1. Thickness: 3.5" inch.

2. Size: To fit acoustical suspension system.

D. Gypsum Board: Non Fire rated type; 1/2" inch thick, ends and edges square, paper faced.

E. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Comply with International Building Code requirements for Seismic Category C.

D. Install according to reflected plans and manufacturer's printed instructions. Unless indicated otherwise, ceilings shall be laid out symmetrically in each space, with no less than half panel tile at the walls.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Hangers shall be attached directly to building structural system and/or floor or roof deck above. In no case will hanging from building mechanical systems, duct, piping, conduit, etc., be permitted. Where interference from building systems does not permit proper attachment of hangers to the building, provide bridging under such items to support hangers at proper spacing. For spaces up to 5'-0" use 2" cold-rolled channels as bridging. For spaces over 5'=0", use 20 ga. metal studs sized as appropriate for the required space.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Install in bed of acoustical sealant.

2. Use longest practical lengths.

3. Overlap and rivet corners.

L. Suspension system, including wall mould, shall be level within 1/8” in 12 feet, with ceiling panels in place.

M. Exposed grid members shall be straight and in alignment. All exposed surfaces shall be flush and level.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces. No border tile shall be less than 4" wide, if this occurs, rework adjacent tile/grid and cut down a 2 x 4 ceiling tile of same type to eliminate small tile section and grid.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.4 CLEANING:

A. Following installation, clean all soiled and discolored surfaces. Remove and replace units which are damaged or improperly installed.

END OF SECTION

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient base.

C. Installation accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.3 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).

D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2014).

E. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing; 2014.

F. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.4 PERFORMANCE REQUIRMENTS

A. Conform to applicable code for fire performance ratings as follows:

1. Critical radiant flux (CRF): Minimum 0.45 watt per square centimeter, per ASTM E 648.

2. Flame spread: maximum 75, per ASTM E 84.

3. Smoke developed: maximum 450, per ASTM E 84.

4. Smoke density: maximum 450, per ASTM E 662.

1.5 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plan.

D. Verification Samples: Submit two samples, match size of product as indicated on the Finish Legend (Sheet A721) illustrating color and pattern for each resilient flooring product specified.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

F. Maintenance Data: Include three (3) copies of maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.7 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.8 EXTRA MATERIALS

A. Provide one unopened box or 20 linear feet of floor tile and 24 lineal feet of base, of each type and color specified.

PART 2 - PRODUCTS

1.4 SHEET FLOORING

A. Welded Seam Sheet Vinyl: FS L-F-475 Type II Grade A, color and pattern through surface wear layer thickness:

1. Minimum Requirements: Comply with ASTM F 1303, Type II, with Class A fibrous backing.

2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.

3. Wear Layer Thickness: 0.080 inch minimum.

4. Total Thickness: 0.080 inch minimum.

5. Sheet Width: 72 inch minimum.

6. Static Load Resistance: 125 psi minimum.

7. Heat welded seams.

8. Integral covered base with cap strip. Provide where indicated on the Room Finish Schedule.

9. Pattern: As indicated on drawings. See sheets A701 & A721.

10. Manufacturers:

    a. As indicated on drawings. See sheets A701 & A721.

    d. Substitutions: See Section 012500 – Substitution Procedures.

B. Rubber Sheet Flooring: 100 percent rubber composition, color and pattern through total thickness.

1. Minimum Requirements: Comply with ASTM F1859, Type 1, without backing.

2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.

3. Total Thickness: Provide manufacturer's standard for products as listed on the Finish Legend (Sheet A721).

4. Sheet Width: Provide manufacturer's standard for products as listed on the Finish Legend (Sheet A721).

5. Design: As indicated on drawings. See sheets A701 & A721.

6. Pattern: As indicated on drawings. See sheets A701 & A721.

7. Manufacturers:

    a. As indicated on drawings. See sheets A701 & A721.

    b. Substitutions: See Section 012500 – Substitution Procedures.

C. Vinyl Welding Rod: Solid vinyl bead produced by manufacturer of vinyl flooring for heat welding seams, in color matching field color.

2.2 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.

1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.

2. Height: 4 inch.

3. Thickness: 0.080 inch thick.

4. Finish: Satin.

5. Length: Roll.

6. Color: As indicated on drawings. See sheets A701 & A721.

7. Manufacturers:

a. As indicated on drawings. See sheets A701 & A721.

d. Substitutions: See Section 012500 – Substitution Procedures.

2.3 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: As indicated on drawings. See sheets A701 & A721.

D. Filler for Coved Base: Plastic filler strip 1 inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive resilient flooring.

C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.

1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

E. Verify that sub-floor surfaces are dust-free and free of substances which would impair bonding of adhesive materials to sub-floor surfaces.

F. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

G. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 SHEET FLOORING

A. Install in accordance with manufacturer's instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Set flooring in place, press with heavy roller to attain full adhesion.

D. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.

E. Double cut sheet at seams.

F. Lay flooring with tightly butted seams, without any seam sealer unless otherwise indicated.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Before installation of flooring, secure metal strips with stainless steel screws. Secure resilient strips by adhesive.

H. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.5 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces. Use only 20 foot lengths. Seams on walls less than 20 feet long will not be acceptable.

3.6 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

C. Clean, seal, and wax resilient flooring products in accordance with manufacturer's instructions.

3.7 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096813 – TILE CARPETING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, loose laid with edges and control grid adhered.

1.2 RELATED REQUIREMENTS

A. Section 096519 - Resilient Tile Flooring: Termination edging of adjacent floor finish and base finish.

1.3 REFERENCE STANDARDS

A. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.

B. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

1.4 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B Shop Drawings: Indicate layout of joints.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Maintenance Data: Provide three (3) copies of a printed maintenance manual written by the Carpet Manufacturer. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.5 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

1.6 EXTRA MATERIALS

A. Provide one full box of carpet tiles or 5%, whichever is greater, of each color and pattern selected.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. As indicated on drawings. See sheet A721.

2. Substitutions: See Section 012500 – Substitution Procedures.

2.2 MATERIALS

A. Carpet Tile: As indicated on drawings. See sheets A701 & A721.

2.3 ACCESSORIES

A. Edge Strips: Rubber, as indicated on drawings.

B. Contact Adhesive: Compatible with carpet material, releasable type.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for carpet tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Install carpet tile in strict accordance with manufacturer's printed instructions.

D. Blend carpet from different cartons to ensure minimal variation in color match.

E. Install carpet under open-bottom obstructions and under removable flanges and furnishings and into alcove and closets of each space.

F. Provide cut outs where required. Carpet tiles that are cut shall be anchored with adhesive.

G. Run carpet under open-bottom items such as heating convectors and install tight against walls, columns and cabinets so that the entire floor area is covered with carpet. Cover over all floor type door closers.

H. Install edging at all openings and doors wherever carpet terminates unless indicated otherwise.

I. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed.

J. Edges shall be butted together with the proper pressure to produce the tightest joint possible without distortion.

K. All carpet shall be installed with pile-lay in the same direction.

L. Align all carpet tiles where they meet and use leveling compound where necessary. Any floor filling or leveling shall have a minimum of 4 feet of feather.

M. Tightness: The accumulated space gained as a result of loose joints shall not be greater than 1/4 inch measured over eleven tiles.

N. Expansion Joints: Do not bridge building expansion joints with continuous carpeting. Provide for movement.

O. Install carpet tiles in the following locations with 100% adhesive coverage:

    1. Perimeters of spaces.

    2. All cut tiles.

P. Apply a strip adhesive along each side of feeder duct covers to anchor carpet tiles adjacent to cover plates.

Q. Spread adhesive using a roller with 1-inch nap or with trowel as applicable.

R. Check the tightness of the joints as work progresses and adjust as necessary. Align and butt joints according to carpet manufacturer's instructions.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 099113 – 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 the following exterior substrates:

1. Steel.
2. Wood.
3. Exterior gypsum board.
4. Fiber cement siding and trim.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

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. Paint: 3 percent, but not less than 10 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

    a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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 (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. 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 (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, Provide products listed in Exterior Paint Schedule at end of this section. Provide products listed, or provide approved products by one of the following manufacturers:

1. Benjamin Moore & Co.
2. Duron, Inc.
3. PPG Architectural Finishes, Inc.
4. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect.

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. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

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. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
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.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI 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. 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. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. 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.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Latex System over Waterborne Primer:

a. Prime Coat: Waterborne metal primer (ICI-Dulux #4020 Devflex DTM Flat Int/Ext Waterborne Primer and Finish). Omit if steel is factory primed.
b. Intermediate Coat: Exterior enamel matching topcoat.
c. Topcoat: Exterior gloss acrylic enamel (ICI-Dulux #4208 Devflex Int/Ext Waterborne Acrylic Gloss Enamel)

B. Galvanized-Metal Substrates:

1. Latex System:

a. Prime Coat: Waterborne metal primer (ICI-Dulux #4020 Devflex DTM Flat Int/Ext Waterborne Primer and Finish).Omit if steel is factory primed.
b. Intermediate Coat: Exterior enamel matching topcoat
c. Topcoat: Exterior gloss acrylic enamel (ICI-Dulux #4208 Devflex Int/Ext WaterborneAcrylic Gloss Enamel).

C. Exterior Wood and Fiber Cement Substrates:

1. Satin Latex System:

a. Prime Coat: Exterior satin latex (ICI-Dulux #2010 Ultra-Hide Durus Acrylic Exterior Primecoat). Omit if siding is pre-primed)
b. Intermediate Coat: Exterior acrylic satin latex matching topcoat.
c. Topcoat: Exterior acrylic satin latex (ICI-Dulux #2412 Ultra-Hide Durus Acrylic Exterior Satin Finish).

D. Exterior Gypsum Board Substrates:

1. Latex System:

    a. Prime Coat: Exterior acrylic latex (ICI-Dulux 2010 Ultra-Hide Durus Acrylic Exterior Primecoat).
    b. Intermediate Coat: Exterior acrylic latex matching topcoat.
    c. Topcoat: Exterior semi-gloss acrylic latex (ICI-Dulux #2416 Ultra-Hide Durus Acrylic Exterior Semi-Gloss Finish).

END OF SECTION 099113

SECTION 099123 – INTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

D. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, Door and Frame rating Labels, equipment serial number and capacity labels, and operating parts of equipment.

5. Color Coding or piping identification.

6. Stainless steel, anodized aluminum, bronze, terne, and lead items.

7. Acoustical tile or suspension systems.

8. Floors, unless specifically so indicated.

9. Glass.

10. Concealed pipes, ducts, and conduits.

E. See Sheets A700 and A721 - Surfaces to be Finished as specified in this Section.

1.2 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.

C. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.3 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 6 x 6 inch in size.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.5 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.6 EXTRA MATERIALS

A. Supply 1 gallon of each color; store where directed.

B. Label each container with color in addition to the manufacturer's label.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Base Manufacturer: Glidden Professional Paints - Pittsburgh Paints: www.gliddenprofessional.com or ppgpro.com.

2. Duron, Inc: www.duron.com.

3. Benjamin Moore & Co: www.benjaminmoore.com.

4. MAB Paints.

5. Porter Paints.

6. Sherwin-Williams Co. www.sherwin-williams.com.

C. Substitutions: See Section 012500 – Substitution Procedures.

2.2 PAINTS AND COATINGS – GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each coating material in quantity required to complete entire project's work from a single production run.

3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.3 PAINT SYSTEMS – INTERIOR

A. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:

1. Filler coat; None required.

2. One coat of stain; Glidden Professional 1700 Woodpride Solvent Based Wood Finishing Stain or PPG Olympic 44500, 41556, 41570 Stain.

3. One coat sealer; Glidden Professsional 1908 Woodpride Polyurethane Gloss Varnish (thinned with one pint of mineral spirits per gallon) or PPG Olumpic 43886 Polyurethane.

4. Gloss: One coat of varnish; Glidden Professional 1908 Woodpride Polyurethane Gloss Varnish or PPG Olumpic 43886 Polyurethane.

5. Satin: One coat of varnish; Glidden Professional 1902 Woodpride Polyurethane Satin Varnish or PPG Olympic 43886 Polyurethane.

B. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:

1. One coat of latex primer; PPG Pitt-Tech DTM Acrylic Primer 90-712.

2. Semi-gloss: Two coats of latex enamel; PPG Pitt-Tech DTM Semi-Gloss 90-1210.

C. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:

1. Touch-up with PPG Pitt-Tech DTM Acrylic Primer 90-712.

2. Gloss: Two coats of latex enamel; PPG Pitt-Tech DTM Gloss 90-374.

3. Semi-gloss: Two coats of latex enamel; PPG Pitt-Tech DTM Semi-Gloss 90-1210.

D. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:

1. One coat of Latex primer sealer; Glidden Professional 9116 Lifemaster No VOC Latex Primer-Sealer or PPG Pure Performance Interior Primer Latex 9-900.

2. Semi-gloss: Two coats of latex enamel; Glidden Professional 9200 Lifemaster No VOC Interior Semi-Gloss Enamel or PPG Pure Performance Interior Semi-Gloss Latex 9-500 Series.

3. Eggshell: Two coats of latex enamel; Glidden Professional 9300 Lifemaster No VOC Interior Eggshell Enamel or PPG Pure Performance Interor Eggshell Latex 9-300XI Series.

4. Flat: Two coats of latex enamel; Glidden Professional 9100 Lifemaster No VOC Interior Flat Wall Paint or PPG Pure Performance Interior Flat Latex 9-100.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.

2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

I. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE - SURFACES TO BE FINISHED

A. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically noted.

2. Fire rating labels, equipment serial number and capacity labels.

3. Stainless steel items.

B. Items to be painted: As indicated on Sheet A721 Finish Schedule & Legend.

END OF SECTION

SECTION 102113 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:

1. Section 061000 – Rough Carpentry: for blocking.

2. Section 102800 "Toilet Accessories" for toilet tissue dispensers, grab bars, and similar accessories.

1.2 ACTION 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 toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.

2. Show locations of centerlines of toilet fixtures.

3. Show ceiling and overhead support locations.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.

2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

B. Stainless-Steel Castings: ASTM A 743/A 743M.

C. Zamac: ASTM B 86, commercial zinc-alloy die castings.

2.2 SOLID-POLYMER UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products “Hiney Hiders” Orange Peel or comparable product by one of the following:

1. Accurate Partitions Corporation.

2. General Partitions Mfg. Corp.

3. Partition Systems Incorporated of South Carolina.

B. Toilet-Enclosure Style: Floor Anchored, Overhead Braced.

C. Urinal-Screen Style: Wall hung, 56 inches high by 18 inches wide.

D. Door, Panel and Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: To be selected from manufacturer’s full range of colors and patterns.

2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless- steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; heavy duty extruded aluminum.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's standard continuous, spring-loaded type 16-gauge stainless steel.

2. Latch and Keeper: Manufacturer's standard stainless steel surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

3. Combination Coat Hook and Bumper: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

4. Coat Hook: Manufacturer’s standard coat hook without bumper at outswinging doors.

5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.

b. Panels and Walls: 1 inch

2. Full Height Brackets: Secure panels to walls and to pilasters with full height brackets.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated on manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 102601 – WALL AND CORNER GUARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall guards.

B. Corner guards.

1.2 RELATED REQUIREMENTS

A. Section 061000 – Rough Carpentry: Support blocking for wall and corner guard anchors.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.4 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.

C. Samples: Submit 1 sections of corner guards and wall guards, 6 inches long, illustrating component design, configuration, color and finish.

1.5 PROJECT CONDITIONS

A. Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Wall and Corner Guards:

1. Construction Specialties, Inc; www.c-sgroup.com.

2. Inpro; www.inprocorp.com.

3. Koroseal Wall Protection Systems.

4. C/S Construction Specialties.

5. Substitutions: See Section 012500 – Substitution Procedures.

2.2 COMPONENTS

A. Wall Guard: Preformed return to wall end caps, internal and external corners:

1. Mounting: Surface.

2. Projection From Wall: 1 inch.

3. Height: 7-3/4 inches minimum.

4. Length: Minimum one piece length not less than 120 inches; flush splicing.

5. Provide Model SCR-80 manufactured by Conspec Systems, Inc. or approved equal unless otherwise indicated on the drawings.

B. Corner Guards - Surface Mounted:

1. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.

2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

3. Width of Wings: Coordinate with drawings; Sheet A721.

4. Corners: Coordinate shapes with drawings; Sheet A721.

5. Color: As selected from manufacturer's standard colors.

6. Length: One piece.

7. Height: As indicated on drawings; Sheet A721.

8. Preformed end caps.

C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.3 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on Drawings.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Install corner guards full height from top of base to bottom of ceiling.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

END OF SECTION

SECTION 102800 – TOILET AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Grab bars.

1.2 RELATED REQUIREMENTS

A. Section 061000 – Rough Carpentry: Support blocking for wall and corner guard anchors.

1.3 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C1036 - Standard Specification for Flat Glass; 2011.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

F. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.4 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

1.5 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Bobrick.

B. Other Acceptable Manufacturers:

1. ASI - American Specialties, Inc; www.americanspecialties.com.

2. Bradley Corporation; www.bradleycorp.com.

3. Gamco.

4. McKinney.

5. Substitutions: See Section 012500 – Substitution Procedures.

C. All items of each type to be made by the same manufacturer.

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.

2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.3 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. Section 061000 – Rough Carpentry: for installation of blocking, reinforcing plates, and concealed anchors in walls.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.

3.4 SCHEDULE - SEE DRAWINGS.

END OF SECTION

SECTION 104400 – FIRE EXTINGUISHER CABINETS AND EXTINGUISHERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Fire extinguishers.

A. Fire extinguisher cabinets.

B. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking and shims.

B. Section 099123 - Interior Painting: Field paint finish.

1.3 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.4 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:

1. JL Industries, Inc; www.jlindustries.com.

2. Larsen's Manufacturing Co; www.larsensmfg.com.

3. Potter-Roemer; www.potterroemer.com.

4. Substitutions: See Section 012500 - Substitution Procedures.

2.2 FIRE EXTINGUISHERS

A. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.

1. Class A;B;C.

2. Size 5 lb.

2.3 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi - Recessed type.

1. SELECT A SIZE

2. 2409-3R (5 lb) as manufactured by Larsen's Mfr. Co.

C. Door: Vertical Duo style; 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

D. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

H. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, ____ inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 107326 – WALKWAY COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Walkway cover systems.
2. Wall-hung entry canopies.

B. Related Information:

1. Section 033000 "Cast-in-Place Concrete" for requirements for concrete footings for walkway coverings.
2. Division 26 electrical sections for power wiring, conduit, and controls for walkway cover lighting.
3. Section 334600 "Subdrainage" for storm water drainage system coordination with walkway coverings downspouts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for walkway coverings.

B. Shop Drawings: For walkway coverings. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Include location, diameter, and projection of anchor bolts required to attach to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary framing. Indicate welds and bolted connections. Include transverse cross connections.
3. Roof Panel Layout Drawings: Show layouts of panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.
4. Column Layout Drawings: Showing locations and details of column drainage outlets for coordination with site drainage.

C. Samples for Initial Selection: For walkway coverings with factory-applied color finishes.

D. Samples for Verification: For exposed finishes, in manufacturer's standard sizes.

E. Delegated-Design Submittal: For walkway coverings 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. Structural Design: Prepare complete structural design calculations for canopy members including piers to be designed to comply with the recommendations of the Project soils report.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Erector and professional engineer.

B. Welding certificates.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For walkway coverings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Erector Qualifications: An experienced erector who is specialized in erecting and installing work similar in material, design, and extent to that indicated for this project and who is acceptable to manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

C. Preinstallation Conference: Conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of anchorages for walkway coverings. 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.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace components of walkway covers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product of one of the following manufacturers:

1. Dittmer Architectural Aluminum.
2. Architectural Fabrication, Inc.
3. Mapes Canopies, LLC.
4. Mitchell Metals.
5. Peachtree Protective Covers.
6. Perfection Architectural Systems, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design walkway coverings.

B. Structural Performance: Walkway coverings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing system to withstand design loads without deflections greater than [**L/180**].

C. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for the following wind-uplift resistance:

1. [Class 90].

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M).
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
4. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M).

B. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or

noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for walkway covering assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

1. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing and inspecting agency.
2. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 1512 conducted by a qualified independent testing and inspecting agency.

    a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

D. Hanger Rod: Stainless steel, threaded to allow for adjustment to ensure drainage from canopy as indicated.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. Fabrication, General: Fabricate members to dimensions, elevations, and details indicated on drawings and approved submittals. Beams and columns shall be factory welded with neatly mitered corners into one-piece rigid bents. All welds shall be smooth and uniform. Grind welds where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints shall be used when shipping limitations prohibit the shipment of fully welded bents.

B. Beams, and Fascias: Extruded aluminum sections of sizes and shapes indicated.

1. Beams: Beams shall be open-top tubular extrusion of size and shape shown on drawings, top edges thickened for strength and designed to receive deck members in self-flashing manner. Structural ties shall be installed in tops of all beams.
2. Notch and fabricate for mechanical connection into one-piece rigid bents.
3. Fabricate and shop heli-arc weld into one-piece rigid bents.
4. Provide cut-outs and internal deflectors in members as indicated to act as internal water drainage system.

C. Columns: Columns shall be radius-cornered tubular extrusion of size shown on drawings with cutout and internal diverter for drainage where indicated.

D. Fascia: Fascia shall be manufacturer's standard shape. Size as indicated on drawings.

E. Flashing: Flashing shall be .040 aluminum (min.). All thru-wall flashing by others.

F. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at 8" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

1. Deck shall be extruded self-flashing sections interlocking into a composite unit. Closures at deck ends shall be welded plates.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. **High-Performance Organic Finish**: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: [**As selected by Architect from manufacturer's full range**].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions existing and provided.

B. Make reasonable adjustments in fabrication and erection to provide an acceptable finished walkway cover.

3.2 INSTALLATION

A. Hanger Rod: Attach hanger rod to imbedded anchor plate in accordance with approved shop drawings.

B. Beams:

1. If mechanically fastened system, place beams in column notches and secure with proper number of fasteners as specified by size of beam and engineering. Ensure contact bearing in bottom of column notches; insert aluminum shim plates as necessary.
2. Level tops of beams to receive roof panels; roof panels shall drain rainwater into beams as indicated.

3. Minor connections and incidental details shall be as shown on the drawings.
4. Ensure that end caps are welded or mechanically fastened securely into place.

C. Roof Panels:

1. Install level and square to beams to avoid "out of square" conditions at beam ends.
2. Secure each contact point with a minimum of three stainless steel fasteners with 3/4 inch (19 mm) flat neoprene washers.

D. Joints Sealants and Flashing:

1. Seal fabrication joints and seams away from view where required.
2. Seal all other points where water penetration might be expected.
3. Flash connection to walls where walkway cover units contact surface of building: do not use sealant.

3.3 CLEANING

A. Remove protective film from members. Clean canopy of dirt, grease, handprints, and other blemishes. Leave area in a neat, clean, and acceptable condition.

Protect canopy from damage from other construction operations. Provide temporary barricades where necessary.

END OF SECTION

SECTION 117100 – MEDICAL EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Owner furnished, Contractor installed medical equipment.

B. Connection to utilities.

1.2 REGULATORY REQUIREMENTS

A. Conform to applicable code for medical equipment.

B. Conform to UL requirements for fabrication and installation of medical equipment.

PART 2 – PRODUCTS

2.1 COMPONENTS

A. Equipment. As provided by the Owner and indicated in the Equipment Schedule.

B. Installation Accessories: Provide all rough-in frames, anchors, supports, accessories and closure trim required for complete installation.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that rough-in frames, anchors and supports are accurately placed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with standards required by authority having jurisdiction.

C. Anchor equipment securely in place.

D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

3.3 SCHEDULES - SEE DRAWINGS

END OF SECTION

SECTION 134905 – X-RAY RADIATION PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lead sheet applied to gypsum board.

B. Lead lined doors.

C. Lead lining to door frames.

D. Prefabricated Lead Lined Windows.

1.2 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames: Lead-lined hollow metal doors and frames.

B. Section 081416 - Flush Wood Doors: Lead-lined flush wood doors.

C. Section 087100 - Door Hardware: Lead-lined door hardware.

D. Section 092116 - Gypsum Board Assemblies: Joint taping over lead lined gypsum board.

E. Section 099123 - Interior Painting: Field painting.

1.3 REFERENCE STANDARDS

A. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2014.

B. NCRP Report 147 - Structural Shielding Design and Evaluation for Medical Uses of X Rays and Gamma Rays of Energies up to 10 MeV; 2004.

1.4 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout, details, dimensions, interface with adjoining work.

C. Product Data: Provide data on leaded glass.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NCRP Report 147 and North Carolina department of Public Health regulations.

B. Maintain one copy of each document on site.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. X-Ray Radiation Protection:

1. A & L Shielding Inc; www.alshielding.com.

2. Radiation Protection Products; www.radiationproducts.com.

3. Ray-Bar Engineering Corp; www.raybareng.net.

4. Substitutions: See Section 012500 – Substitution Procedures.

2.2 LEAD SHEET AND ASSOCIATED MATERIALS

A. Sheet Lead: ASTM B 749 in required thickness.

B. Lead Laminated Gypsum Board: FS QQ-L-201, factory laminated with permanent resilient adhesive to unpierced sheet lead and arranged to provide effective lead insulation through all joints. Provide lead insulated drywall fasteners and lead buttons to cover screw heads.

2.3 FABRICATION

A. Lead Laminated Gypsum Board: Fabricate with monolithic sheet lead bonded to one surface of board, extend lead sheet 1 inch beyond one side and one end of board.

B. Lead Lined Wood Doors: Specified in Section 081416.

C. Lead Lined Door Frames: Specified in Section 081113.

D. Hardware: Specified in Section 087100.

2.4 PREFABRICATED LEAD PLASTIC CONTROL WINDOWS

A. Prefabricated control windows shall be as manufactured by Nuclear Associates or approved equal.

B. Barrier panels shall be manufacturer's standard vinyl laminate, lead-lined to provide 1.5 mm lead protection. Barriers shall include vertical and horizontal coupling channels as required.

C. View windows shall be fabricated from "Clear Pb" shatter-resistant lead plastic. Lead plastic shall provide shielding requirements as indicated on the Drawings for which the lead partition is rated.

D. Prefabricated view window modules shall be as manufactured by Nuclear Associates or approved equal and shall be complete with edge frames, corner closures, overhead braces and other required hardware for a complete installation. Provide modules where indicated on the drawings.

E. All lead plastic control windows shall meet requirements for radiation protection equivalent or greater than the requirements as shown on the Drawings for the partition in which they are located.

2.5 COMPONENTS AND ACCESSORIES

A. Radiation Protection Plaque: Wall mounted, designating lead thickness in wall, degree of continuity, exceptions.

2.6 FINISHES

A. Field painted surfaces: As specified in Section 099123.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that existing surfaces are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Lead Laminated Gypsum Board:

1. Install lead laminated gypsum board in strict accordance with the Manufacturer's Shop Drawings.

2. Use all recommended fastening accessories recommended by manufacturer in printed instruction.

3. It is required that lead laminated gypsum board be installed behind all ducts located in X-Ray Room partitions.

B. Sheet Lead:

1. Provide and install overlapping sheet lead, shielding of required thickness for that partition into stops of door frames located in those partitions.

2. Provide and install channel formed sheet lead shielding of required thickness for door in opening in which threshold shielding is located.

C. Prefabricated Lead Plastic Control Windows: Install in strict accordance with Manufacturer's Shop Drawings as approved by the Architect.

3.3 INSTALLATION - COMPONENTS AND ACCESSORIES

A. Install components and accessories in accordance with manufacturer's instructions.

B. Install lead lined doors in accordance with Section 081416. Coordinate installation of door hardware.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 014000 – Quality Requirements.

B. Inspection and testing will be performed by a licensed radiologist technician in coordination with regulatory agency requirements, to ascertain conformance of installation regarding radiation passage or leakage.

END OF SECTION

TABLE OF CONTENTS

DIVISION 22 – PLUMBING

SECTION 220100 – GENERAL PROVISIONS - PLUMBING
SECTION 220208 - PLUMBING IDENTIFICATION AND PAINTING
SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING
SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING
SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING
SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
SECTION 220719 - PLUMBING PIPING INSULATION
SECTION 221116 - DOMESTIC WATER PIPING
SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES
SECTION 221316 - SANITARY WASTE AND VENT PIPING
SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES
SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS
SECTION 224213.13 - COMMERCIAL WATER CLOSETS
SECTION 224216.13 - COMMERCIAL LAVATORIES
SECTION 224216.16 - COMMERCIAL SINKS
SECTION 224500 - EMERGENCY PLUMBING FIXTURES
SECTION 229000 - PROJECT CLOSEOUT

SECTION 220100 – GENERAL PROVISIONS – PLUMBING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The work to be done under Division 22 contract shall include the furnishing of all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all work as shown on the plans and herein specified, excepting only work materials specified or noted as being furnished or installed by others.

B. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotation.

C. The Plumbing contractor may hereinafter also be referred to as "This contractor," "PC", or Division 22 contractor.

D. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor, and ceiling to ensure proper rough-in and installation of work.

1.2 WORK INCLUDED:

A. The plumbing contractor shall be responsible for including the cost of all labor, accessories, tools, equipment, and materials required to completely execute installation of the entire plumbing systems as shown on the drawings and as specified. Work under the plumbing contract shall include, but shall not be limited to, the furnishing, unloading, handling, distribution, setting and installation of all components required for the following systems:
   1. Water service (interior to the building).
   2. Sanitary sewers (interior and exterior to a point 5'-0" outside the building).
   3. Special drainage work as hereinafter specified.
   4. Hot and cold domestic water systems.
   5. Piping Specialties.
   6. Insulation on plumbing systems.
   7. Plumbing fixtures.
   8. Rough-in and final connections.
   9. Miscellaneous items as specified, required and/or shown on drawings.
   10. All vents, safety valves, vacuum breakers, drain and piping systems as required by applicable

1.3 RELATED WORK WHICH IS A PART OF SECTION 220100:

A. All work done under this section of the specification is subject to the Architect's instructions to bidders, general conditions, and their corresponding supplements.

B. Refer to the supplementary general conditions of these specifications for temporary services and facilities that shall be provided.

1.4 DEFINITIONS:

A. "Piping": Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids.

B. "Ductwork": All air delivery, recirculation, and exhaust ducts, whether of sheet metal or other material, and includes all connections, accessories, and appurtenances necessary for and incidental to a complete system.

C. "Provide" (P): Furnish and install complete ready for use.

D. "Furnish" (F): Purchase and deliver to the project site complete with every necessary appurtenance and support.

E. "Install"(I): Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation of the proper location in the project.

F. "Concealed": Embedded in masonry or other construction, installed behind wall furring, within double partitions of hung ceilings, in crawl spaces, in shafts.

G. "By Other Trades": Shall mean by persons or parties who are not anticipated to be the Plumbing Contractor this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.5 ABBREVIATIONS:

1.	AD	Access Door
2.	AFF	Above Finish Floor
3.	AMP	Amperes
4.	AP	Access Panel
5.	AV	Air Vent
6.	BO	By Others
7.	C	Conduit
8.	CAB	Cabinet
9.	CI	Cast Iron
10.	CL	Ceiling
11.	CO	Clean Out (F-Floor) (W-Wall) (Y-Yard)
12.	CONTR	Contractor
13.	CP	Circulating Pump
14.	DB	Decibels
15.	DIS.SW	Disconnect Switch
16.	DN	Down
17.	ELEC	Electrical
18.	FD	Floor Drain

19.	FL	Floor
20.	HB	Hose Bibb
21.	I	Install
22.	IE	Invert Elevation
23.	NC	Noise Criteria
24.	P	Provided (Furnished & Installed)
25.	PLBG	Plumbing
26.	UF	Underfloor
27.	UG	Underground
28.	VCP	Vitrified Clay Tile Pipe
29.	WC	Water Closet
30.	Ø or PH	Current Phase

1.6 INTERPRETATION OF CONTRACT DOCUMENTS:

A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether this instruction is explicitly stated as part of the indication or description.

B. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are that notes on the drawings, which refer to a specific element of work, take precedence over the specifications where they may conflict.

C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

D. The drawings of necessity utilize symbols as schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

F. Certain details appear on the drawings which are specific regarding the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.

G. Information as to the general construction shall be derived from structural and architectural drawings and specification only.

H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.7 DELINEATION OF WORK:

A. The plumbing contractor is required to supply all necessary supervision and coordination of information to any others who are performing work to accommodate plumbing installations. Where the plumbing contractor is required to install items which he does not purchase, he shall include for such items:
   1. The coordination of their delivery.
   2. Their unloading from delivery trucks driven into any designated point on the property line.
   3. Their safe handling and field storage up to the time of permanent placement in the project.
   4. The correction of any damage, defacement, or corrosion to which they may have been subjected.
   5. Their field assembly and internal connections as may be necessary for their proper operation.
   6. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
   7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

B. Items which are to be installed but not purchased as part of the work of the plumbing contractor shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The work under this contract shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

C. The specifications for the overall construction delineate various items of work under separate section headings. The list below set forth this delineation to the extent that it affects the plumbing work category. In the absence of more detailed information, this list shall be taken as a specific instruction to the plumbing contractor to include the work assigned to him. Indications that each contractor is to perform the work means that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

"P" indicates Provide
"F" indicates Furnish
"I" indicates Install

Item	"General"	"Plumbing"	"HVAC"
Motors for plumbing equipment		P	
Motor controls for plumbing equipment		P	
Power wiring for plumbing equipment	Refer to Section 220104		

Item	"General"	"Plumbing"	"HVAC"
EXCEPTION: Refer to notes on drawings.			
Hoisting		P	
Rigging		P	
Cutting and Patching		P	
EXCEPTION: Cost where due to late installation or improper coordination of work is the responsibility of the delinquent contractor. Locations shall be approved by structural engineer.			
Framed slots and openings in walls, decks, and slabs		P	
EXCEPTION: Coordination drawings are required from plumbing contractor.			
Sleeves through non-membraned slabs, decks, and walls		P	
EXCEPTION: Refer to Division 03 for coordination of installation.			
Sleeves through membraned slabs, decks, and walls		P	
EXCEPTION: Refer to Division 03 for coordination of installation.			
Fireproof sealing of excess opening in slabs, decks, and fire rate walls		P	
Excavation and backfill of trenches inside building		P	
EXCEPTION: Specifications and drawings delineate exceptions.			
Blasting		P	
EXCEPTION: Only with permission of Architect.			
Keeping trench excavations free from water during construction		P	
EXCEPTION: The general contractor shall be responsible for keeping the entire site free from surface water.			

Item	"General"	"Plumbing"	"HVAC"
Fastenings		P	
Supports		P	
Concrete foundations, pads, and bases inside buildings		P	
Field touch-up painting damaged shop coats		P	
Finish painting of exposed work		P	

EXCEPTION: Painting of equipment, piping etc. in mechanical spaces provided by plumbing contractor. The plumbing contractor shall prime all exposed piping, etc. in finished spaces.

Finished wall and ceiling access doors, panels, and support frames	I	F	

EXCEPTION: Plumbing contractor shall supply and locate all required access doors to the installing trade.

Removal of spray on fire proofing from plumbing equipment, hangers, etc.	P		
Rubbish Removal		P	

EXCEPTION: Where one trade furnishes and another installs, the installing trade shall remove the shipping and packing material which accumulate.

Special tools for equipment maintenance		P	
Piping and associated work outside of the building line		P	

EXCEPTION: Rough-in and final connection shall be provided by the plumbing contractor providing specified services.

D. This plumbing contractor is required to supply all necessary supervision and coordination of information to any others who are supplying work to accommodate his installation.

1.8 STANDARDS AND CODES:

A. Nothing in this specification shall be interpreted to conflict with any City or State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.

B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction."

C. All equipment with electrical components shall bear the UL label.

D. The following minimum standards apply wherever applicable:

1.	ANS	American National Standards
2.	ASTM	American Society for Testing Materials
3.	NEMA	National Electrical Manufacturers Association
4.	NFPA	National Fire Protection Association
5.	OSHA	Occupational Safety and Health Act
6.	AGA	American Gas Association
7.	ASA	American Standards Association
8.	AWWA	American Water Works Association
9.	CISPI	Cast Iron Soil Pipe Institute
10.	NBFU	National Board of Fire Underwriters
11.	PDI	Plumbing and Drainage Institute

1.9 INSPECTION AND COOPERATION:

A. All work shall be done under the periodic observation of and to the complete satisfaction of the Architect. No deviations from the Drawings and Specifications will be allowed without prior written approval of the Architect. The plumbing contractor shall cooperate with the other contractors to allow for the installation of their work as well as his own.

B. The plumbing contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this contractor without regard for other work, or if a conflict results, must be changed if directed by the Architect or Engineer without additional cost to Owner or his agents.

C. Relocation of equipment, piping, system connections or rough-in locations up to ten feet (10') in any direction, if necessary, shall be done at no additional cost to the Owner or his agents upon notification, or as determined by the preparation of fabrication or coordinated shop drawings, prior to installation.

D. All concealed work shall be inspected by the Architect or his appointed representative before being concealed. Plumbing Contractor shall call for inspection at least two (2) workdays before concealment.

E. The Architect shall have the right to inspect the work whenever advisable in his judgment. The plumbing contractor shall have a representative present at each inspection and shall give such assistance as may be required.

F. Recommendations made by the Architect shall be promptly carried out and all unsatisfactory material and workmanship replaced at once to the Architect's satisfaction at the contractor's expense.

G. The plumbing contractor shall be responsible for hoisting of all materials and equipment furnished under as part of his portion of the work in accordance with all State, and Federal rules and regulations.

1.10 TEMPORARY SERVICES AND FACILITIES:

A. Refer to general requirements for temporary services and facilities that shall be provided.

1.11 UNIT PRICES:

A. Refer to general requirements relative to "Add" or "Deduct" prices relative to this contract.

1.12 ROCK DEFINITION:

A. Refer to Division 31 for definitions and requirements relative to rock encountered during excavation.

1.13 SUBMITTALS:

A. LIST OF MANUFACTURERS: Within twenty days following award of contract, the plumbing contractor shall submit the required information pertaining to the equipment and materials he will be furnishing, commencing with the list of manufacturers for approval by the engineer. Following up in short order shall be the shop drawings and other documents. The Owner and his representatives reserve the right to reject as unacceptable any items for which, in their judgment, they have not been allowed adequate lead time in which to investigate suitability, or their experience has proved the service or equipment unsatisfactory.

Section	Item	Manufacturers		
220204	Motors	Westinghouse	Wagner	Gould Century
220208	Identification	Seton	Calpico	SSC
220510	Pipe	Republic Steel	National Tube	Youngstown
220510	Fittings	Tube-Turn	Grinnell	Ladish

Section	Item	Manufacturers		
220510	Vacuum Breakers	Bidero	Watts	Wilkens
220510	Pipe Thread Compound	Crane	Dixon	Rutland
220512	Sleeves	Pipe Shields	R&S Mfg	Clow
220512	Hangers	Modern	F&S	Grinnell
220512	Escutcheon	U.S. Brass	Brass Craft	Central Brass
220512	Fire Sealant	ChaseFoam	3M	Proset
220512	Access Doors	Milcor	Acorn	Sioux Chief
220512	Pipe Supplies	F&S	F&M	Grinnell
220512	Hot Water Expansion Tank	Wessels	Amtrol	B&G
220512	Reduced Pressure Backflow Preventer	Wilkins	Watts	Febco
220512	Thermostatic Mixing Valve	Lawler	Powers	Heat Timer
220523	Valves	Hammond	Jenkins	Fairbanks
220523	Circuit Setters	B&G	Taco	Thrush
220523	Silent Check Valves	William and Hager	Watts	Ames
220523	Gravity Flow Check Valves	B & G	Taco	Armstrong
220700	Insulation	Certainteed	Owens-Corning	Knauff
220700	Insulation Mastic	Benjamin & Foster	Armstrong	3M
221301	Thermometers	Weksler	Palmer	Trerice
221301	Pressure Gauges	Ashcroft	Palmer	Trerice
222113	Specialties	B&G	Taco	Armstrong
222113	Unions	Grinnell	Watts	Wilkens
222113	Safety Valves	Lonegran	Kunkle	Crane
222113	Strainers	Watts	Febco	Hammond
223300	Domestic Water Heater	PV1	Lochinar	A.O Smith

Section	Item	Manufacturers		
224000	Plumbing Fixtures	Crane	Kohler	American Standard
224000	Plumbing Trim	Delta	Kohler	T & S Brass
224000	Flush Valves	Delany Co.	Sloan Royal Co.	Zurn
224000	Fixture Seats	Bemis Mfg. Co.	Kohler	Olsonite
224000	Water Coolers	Elkay	Haws	Sunroc Corp.
224000	Stainless Steel Sinks	Elkay Mfg.	Just Mfg.	Kohler
224000	Fixture Carriers	Josam Mfg.	Zurn	JR Smith

1.14 SHOP DRAWINGS:

A. Prior to purchasing any equipment or materials, the approved list of the manufacturers shall be returned by the Engineer to the plumbing contractor.

B. Shop drawings shall be submitted conforming to the requirements stated in supplementary conditions and Division I for the items indicated throughout the following specifications:

C. Documents will not be accepted for approval unless:
1. They comply with the requirements of the supplement to the General Conditions.
2. They include complete information pertaining to appurtenances and accessories.
3. They are submitted as a package where they pertain to related items.
4. They are properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable and are marked with pertinent specification paragraph number.
5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.
6. The submittal is stamped approved by the Plumbing contractor and contain no other markings.

D. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

1.15 FABRICATION DRAWINGS:

A. Prior to assembling or installing the work, the following shall be submitted to the Architect by the plumbing contractor:

B. Scaled drawings indicating insert and sleeve locations. The background shall include the structural framing plan.

C. Scaled drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, conduit, sprinkler systems, ductwork, lighting fixtures, structure, and equipment. Supervisor or foreman of the Plumbing, Mechanical and Electrical installing trade shall review drawings for coordination and initial each (as a sign of approval) drawing he reviews.

D. Scaled drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, ductwork, and equipment in equipment rooms.

E. The following general rules shall apply to the proceeding items:
   1. Service piping (water, etc.) shall generally be run below ductwork so they will be accessible for service and modifications. The pipes will be offset as required to avoid interfering with access to duct access to duct access panels, dampers, etc.
   2. Ducts will have next priority. Ducts will be offset as required to avoid pipes.
   3. Where pipes of different trades conflict, such as domestic water vs. vent or sanitary, the smaller pipe shall be offset.
   4. Plumbing Contractor shall make field water, waste and vent riser isometrics as required to comply with local code interpretations as herein stated or as required by local authorities having jurisdiction if not compatible with bid documents.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used in this work shall be new unless otherwise noted. All materials used on this project shall be listed and labeled by one of the third-party agencies which have been approved by the U.L. building authority housing jurisdiction to safety test and label electrical and mechanical equipment. Any material installed that is not labeled shall be subject to a field evaluation by one of these approved agencies, at the contractor’s expense, if requested by the authority having jurisdiction or the engineer. Any item not approved by the agency shall be replaced by the contractor at his expense. It shall be the contractor’s responsibility to verify that materials specified or used on the project are labeled.

2.2 MATERIALS AND MANUFACTURERS:

A. All equipment and materials required for installation under these specifications shall be new manufactured and without blemish or defect. All equipment shall bear labels attesting to Underwriter Laboratories approval where subject to Underwriters Laboratory label service. Where no specific indication as to the type of material or equipment is indicated a first-class standard article shall be furnished.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. It is the intent of the specifications that wherever manufacturers of a product are specified any substituted item must conform in all respects to the specified item. Consideration will not be

given to claims that the substituted item meets the performance requirements with lesser construction such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

C. Substituted equipment where permitted or approved, must conform to space requirements, whether approved or not or shall be replaced at the plumbing contractor's expense. Any modification of related systems because of substitutions shall be made at the plumbing contractor's expense.

D. Note the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or the ability of the material or equipment involved or the mechanical performance of the equipment.

2.3 SUBSTITUTION OF SPECIFIED MATERIALS:

A. It is the purpose of this specification not to exclude competition between manufacturers of similar equipment.

B. Where items are specified as "or approved equivalent" prior approval must be obtained from the Engineer. Said approval does not intend to obligate the Engineer in the event shop drawings submitted do not indicate equality of materials, workmanship or function and the right to reject substitutes shall remain the prerogative of the Engineer.

C. In all cases regardless of method of submission, the plumbing contractor shall be completely responsible for changes in dimension of other than first named manufacturer equipment, electrical changes, etc. required for proper function and final performance. Item shall comply with all requirements herein set forth and as required to perform as designed. Minor modifications to suit standard manufactured items are acceptable if approved by Engineer.

D. Should contract documents fail to describe the materials or goods to be used, then it shall be the duty of plumbing contractor to inquire of Engineer as to what is to be used and to supply it at plumbing contractor's expense.

E. Plumbing Contractor shall promptly remove, at own expense, rejected materials from site of work.

F. When material has been approved, no change in brand or make will be permitted without approval of Engineer.

2.4 NAMEPLATES:

A. All items of operation equipment used on the project shall be provided with a nameplate mounted in a conspicuous place on the unit. Plate shall be embossed metal or stamped metal securely fastened to the unit.

B. The plate shall contain the following information:
   1. Manufacturer's name and address.
   2. All approval stamps, AGA, UL, etc. as hereinafter specified.
   3. Complete capacity and operating data as approved by Engineer
   4. Motor Characteristics
   5. Serial number and code numbers
   6. Date of manufacturer

2.5 RECORD DRAWINGS:

A. Purchase and maintain at the job site a complete and separate set of prints of the approved working Drawings on which to accurately indicate daily progress by coloring materials and apparatus as installed. Schedules shall be modified to reflect data consistent with that of the installed equipment. Clearly show all changes to the work because of change orders, instruction issued by the Architect or conditions encountered in the field. Accurately indicate the location, size, type and elevation of new utilities and their relationship to existing utilities.

B. The marked-up and colored-in prints will be used as a guide for determining the progress of the work installed. They shall be inspected at the architect's discretion and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment may not be approved until the drawings are accurate and up to date.

C. The plumbing contractor shall provide one set of marked plans to the Engineer for his review and approval of record drawings. The approved plans shall be returned to the contractor for his CADD preparation of documents using version 2010 to indicate correct location of all equipment, piping, etc. as installed on project.

D. The drawings shall provide an accurate and complete record of the work as installed.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

A. Workmanship shall be of best quality. Good appearance of finished work shall be of equal importance with its mechanical efficiency. No makeshifts shall be permitted anywhere in work and all portions of work shall be laid out and installed so that work as a whole is of uniform quality and appearance.

3.2 PROTECTION OF EQUIPMENT:

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period.

B. Protection from damage from rain, dirt, sun and ground water shall be accomplished by storing the equipment on elevated supports and covering them on all sides with protective rigid or flexible waterproof coverings securely fastened.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable material to prevent dirt accumulation in the piping.

D. The plumbing contractor shall be responsible for the work damaged by him in executing this contract. Any work damaged by the plumbing contractor shall be replaced by him and placed in perfect condition without extra cost.

3.3 CONTIGUOUS WORK:

A. If any part of the plumbing contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the contractor shall examine and measure such contiguous work and report to the Architect in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should plumbing contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible.

3.4 CERTIFICATES OF INSPECTION AND APPROVAL:

A. Upon completion of work, plumbing contractor shall furnish to the Owner certificates of inspection or approval from the authorities having jurisdiction if certificates of inspection or approval are required by law or regulation.

3.5 SLEEVES AND OPENINGS:

A. All sleeves and openings required shall be located and provided by the plumbing contractor for his portion of the work. Core drilling for missed sleeves shall be provided by the delinquent contractor.

B. To minimize liquid leakage or transfer of air between floors, it is the intent that pipe penetrations of floors (except in plumbing chases) be held to a minimum. Where it is necessary to penetrate floors, the pipe shall pass through sleeves set in the concrete, and the space between the pipe and sleeve shall be caulked to make it airtight.

3.6 ACCESS TO EQUIPMENT AND VALVES:

A. All control devices, specialties, valves, and removable panels on equipment shall be so located as to provide easy access for inspection and maintenance, including removal of any interior components.

B. Should any work, such as piping, ducts, conduit, etc. be installed without due regard to the accessibility of devices installed by other contractors, the installation shall be relocated, offset, or rerouted without cost to the Owner.

C. Where devices are to be concealed in walls or above nonremovable ceilings, the plumbing contractor shall furnish the required access panels to the GC for installation for their respective equipment.

D. Size of panels shall be 12" x 12" square for all wall panels and 24" x 24" for ceiling panels.

3.7 COORDINATION:

A. The plumbing contractor is cautioned that portions of the building have an unusually high quantity of piping, ducts, conduits, and other mechanical equipment, and space is limited. The contractor shall offset pipes as required to avoid interference at no additional cost to the Owner. Generally, pipes in which grade must be maintained, such as waste and vent piping, shall have priority. Other pipes shall be offset as required to avoid those items. The HVAC contractor will be required to prepare coordinated shop drawings of the ductwork. The Plumbing Contractor will be furnished copies of these drawings and shall use them for his coordination drawing efforts and in determining pipe routing.

B. The HVAC contractor will make the basic duct drawings and send sepias to the plumbing contractor. Within 30 days after receiving the sepias and “CADD disk”, the plumbing contractor shall return them to the mechanical subcontractor, marked to show how plumbing pipes cross the ducts, and with suggested pipe elevation for each pipe. The HVAC contractor will use this information plus similar information received from other contractors to prepare the finished coordination drawings.

C. The HVAC contractor shall provide manufacturers installation drawings as shipped with equipment, field working and location drawings, coordination drawings, wiring diagrams as required to show information required for information and coordination of the work for other trades. This includes locations of equipment, sleeves, foundations, curbs, pipe connections, wiring connections, etc. These drawings shall be provided in advance of work in the area so that the necessary coordination can be done at the proper time. The drawings shall be submitted to the A/E for record only and other subcontractors involved in the work.

D. The HVAC contractor shall coordinate the work of his trade and other trades in order that interference between plumbing, mechanical, electrical, architectural, and structural work will be avoided. Piping, ducts, conduits, etc. shall be kept as close as possible to ceiling, walls, columns, etc. to take up the minimum amount of space; and all offsets, fittings, etc. required shall be furnished without additional cost to the Owner. In case interferences develop, the Engineer will decide which equipment shall be relocated regardless of which was first installed.

E. Minor changes required by Owner, and any incidental changes required to meet structural conditions or to match trim etc. shall be made by this contractor without extra cost to the Owner. Generally, all pipes, and conduits except those in the equipment room and in other locations specifically designated on the plans shall be run concealed in furrings and chases. If it is necessary to expose these items in finished areas, this shall be called to the Architect's attention before proceeding with the work.

F. The plumbing contractor shall cooperate closely with the General Contractor and all other contractors on the job in order that the job will progress smoothly to its completion. He shall lay out his pipe in advance of pouring floors, or installing walls, shall provide to the General Contractor the location and size of any openings he may require, and shall furnish for the installation by the General Contractor any sleeves, forms, inserts, or hangers required for his work. In the event of failure to do these things at the proper time, or improper location of the required items, the cutting and patching required to rectify the errors shall be done by the plumbing contractor who installed the original material being cut but shall be paid by the contractor at fault, as determined by the Engineer, at no additional cost to the Owner.

G. All equipment shall be installed with sufficient access and clearance for maintenance, repairs, and replacement. If it appears necessary to install equipment without proper access or clearance, the work shall be stopped until written permission is received from the Engineer to install the equipment. Pipes shall be installed in such a way as to allow maximum headroom where pipes are in occupied areas. Valves shall be in such a position that they are easily accessible and so that the valve wheels can be easily turned to full open or full closed positions.

3.8 CHASES, CUTTING AND PATCHING:

A. In new construction, chases in walls for any work to be installed by the plumbing contractor will be provided by the general contractor provided full information as to the location and size of such chases and the necessary frame for openings is given to him by this contractor in such time as to cause no delay in the general contractor's work.

B. If this contractor should neglect to furnish the required information and by reason of his neglect chases and openings are not provided, the delinquent plumbing contractor shall, at his own expense, cut the required chases and openings and make such repairs as shall be necessary to restore the work to its original finish.

C. The cutting of chases, openings, or holes in floors and ceilings shall be done in a manner as not to endanger the stability of the structure or any part thereof. The Plumbing contractors shall not in any case cut or alter the work of any other contractor without the approval and under the direction of the Architect or Engineer. All repairs resulting from cutting shall be under the supervision of the Superintendent of the General Contractor.

3.9 DISCREPANCIES:

A. In the event of discrepancy, immediately notify the architect for clarification and resolution.

B. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.10 JOB CONDITIONS:

A. Safety: Observe all required safety regulations and the manufacturer's warnings and instructions during the storage, handling, and applications of materials.

B. Necessary precautions shall be taken to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.

C. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at the end of each day's work, in accordance with all applicable federal, state, and local codes.

END OF SECTION 220100

SECTION 220208 – PLUMBING IDENTIFICATION AND PAINTING

PART 1 - GENERAL

1.1 SCOPE:

A. All exposed pipe, hangers, and equipment installed by this subcontractor shall be painted unless it has a factory finish or is noted otherwise. Exposed chrome plated brass, stainless steel, or plastic piping will not be painted.

B. Type of identification devices specified in this section include the following:
   1. Plastic Pipe Markers
   2. Plastic Tape
   3. Valve Tags
   4. Valve Schedule Frames
   5. Engraved Plastic-Laminate Signs

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.3 SUBMITTALS:

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags," in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 22.

PART 2 - PRODUCTS:

2.1 PLASTIC PIPE MARKERS:

A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

B. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.
   3. Laminated or bonded application of pipe marker to pipe (or insulation).
   4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

C. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   1. Laminated or bonded application of pipe marker to pipe (or insulation).
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless-steel bands.

D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.2 PLASTIC TAPE:

A. Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.3 VALVE TAGS:

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.4 VALVE SCHEDULE FRAMES:

A. For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 LETTERING AND GRAPHICS:

A. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown pre-existing, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer's or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H).

2.7 PAINT:

A. All products shall be in accordance with the specifications for painting in the general contract.

PART 3 - EXECUTION:

3.1 GENERAL:

A. Any equipment shipped with a factory applied finish shall be touched up to repair any damage to the finish so that it is the same as new.

B. In the mechanical equipment rooms the plumbing contractor shall be responsible for painting all piping, equipment, and accessories installed under their respective contract.

C. In other parts of the buildings items which are in place in finished areas when general building painting is done will be painted by the General Contractor. Items installed after painting is completed shall be painted by the plumbing contractor, as directed by the architect.

D. All exposed nongalvanized ferrous metal hangers and miscellaneous metal used in connection with the plumbing systems shall be painted with two coats of enamel.

E. All exposed piping including insulated piping, insulated by this contractor shall be painted two coats of lead and oil paint. Elastomeric pipe insulation shall have two coats of enamel of the type recommended by the insulation manufacturer.

F. Do not field paint exposed copper pipe, brass valves, or brass trim on iron body valves, or machinery or equipment that has a factory applied finish unless otherwise specified. Do not paint plastic pipe.

G. Painted pipes which are buried in earth, shall be allowed to dry before backfilling.

H. All paint shall be delivered to the project in unbroken containers. Containers shall be labeled to indicate color, directions for use, manufacture, and date of manufacturer. Directions for use of the paint shall be carefully followed in the mixing and general application. All paint shall be applied under dry and dust free conditions. Sufficient time shall elapse between paint coats to permit satisfactory recoating. Once started all painting shall be completed without delay.

3.2 PIPING SYSTEM IDENTIFICATION:

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.
   1. Near each valve and control device.
   2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
   4. At access doors, manholes and similar access points which permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings.

3.3 PAINT SCHEDULE:

A. All exposed equipment, pipes, conduits, or other appurtenances shall be painted by this sub-contractor with materials and application as specified in the general contract specifications and as directed by the architect.

B. All concealed pipe covering shall be identified by colored bands and legends. The direction of flow shall be indicated by flow arrows.

C. All exposed pipe covering shall be totally painted the color of the band color listed below. All exposed pipe hangers, rods, supports, channels, etc. shall be painted flat black.

D. Color coding strips shall be painted no less than every 15 linear feet plus wherever entering or leaving a space and near valves. (Tape is acceptable). Width of strip shall be approximately 1/5 of the diameter of pipe plus covering if any, but in no case less than 1/2 inch. Color coding shall conform OSHA requirement.

E. Directions arrow and fluid name shall be applied by sticker at same spacing as above. The stickers shall be secured by color coded tape wrapped two times around the pipe at each end of the label or spring cords.

F. Standard colors and legends are as follows: (Plumbing)
1. PIPE IDENTIFICATION: Piping systems in mechanical rooms shall be completely painted with the applicable colors listed below and have appropriate self-sticking or strap-on identifications and arrows indicating direction of flow. Piping and ducts in chases above ceiling, etc. shall be color banded and have stencil markings at appropriate intervals. On straight runs of piping, markings should be no further than 30 feet apart; and stencil identifications, color bands, and direction arrows shall be near each valve, pressure reducing valve, heat exchanger, etc. Where pipe passes through walls or floors, marking shall be near the penetration on both sides. Markings shall be at each directional change of all piping systems. Mechanical room pipe color and the color of bands are to be as follows:

PIPING SYSTEM		COLORS	STENCIL IDENTIFICATION
a.	Water, Cold Domestic	Safety Green	DOM CW
b.	Water, Hot Domestic	Safety Orange	DHW
c.	Water, Hot Domestic Recirculating	Safety Orange	DHWR
d.	Supports, Hangers	Safety Black	

2. Pipe identification should contrast in color to the pipe colors and be easily readable. The width of color bands should be equal to the size of the stencil indicated below.

G. For insulated pipe systems, stencil sizes should be as follows:
   1. For pipes up to 1 inch, use 1-inch letters.
   2. For pipes 1 inch to 2 inches, use 2-inch letters.
   3. For pipes 2 inches to 6 inches, use 3-inch letters.
   4. For pipes above 6 inches, use 4-inch letters.

H. For un-insulated systems, stencil sizes should be as follows:
   1. For pipe diameters up to 1 inch, use 1/2-inch letters.
   2. For pipe diameters from 1 inch to 2 inches, use 1-inch letters.
   3. For pipe diameters from 2 inches to 6 inches, use 2-inch letters.

I. Valve handle shall be painted the same color as the stripes on the pipe.

3.4 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

3.5 PLUMBING EQUIPMENT IDENTIFICATION:

A. Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   2. Pumps and similar motor-driven units.

B. Lettering Size: Minimum 3/8" high lettering for name of unit where viewing distance is less than 2'-0", 3/4" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

D. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

END OF SECTION 220208

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Re-greaseable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class B.

H. Code Letter Designation:

1. Motors 1 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 1 HP: Manufacturer's standard starting characteristic.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop collar.

C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded water stop collar.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

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

1. Jay R. Smith Mfg Co; a division of Morris Group International.
2. Zurn Industries, LLC.

B. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description: Manufactured plastic, sleeve-type, water stop assembly made for imbedding in concrete slab or wall.

C. Plastic or rubber water stop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Non-shrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

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

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Permathane®/Acryl-R®; ITW Polymers Sealants North America.
c. Polymeric Systems, Inc.
d. Sherwin-Williams Company (The).
e. The Dow Chemical Company.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. May National Associates, Inc.; a subsidiary of Sika Corporation.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Smooth-On.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 4: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 2 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 2: Steel pipe sleeves.

3. Interior Partitions:

a. Piping Smaller Than NPS 4: Steel pipe sleeves.
b. Piping NPS 4 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The).
5. Mid-America Fittings, Inc.
6. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
   b. Chrome-Plated Piping: One-piece steel or split-casting brass with polished, chrome-plated finish.
   c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
   f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

   a. Chrome-Plated Piping: Split-casting, stamped steel with concealed hinge with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Liquid-in-glass thermometers.
2. Thermowells.
3. Pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.

7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. WATTS.
12. Weiss Instruments, Inc.
13. Weksler Glass Thermometer Corp.
14. WIKA Instrument Corporation.
15. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, rigid back and rigid bottom, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1.5 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

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

a. Flo Fab Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Tel-Tru Manufacturing Company.
e. Trerice, H. O. Co.
f. Weiss Instruments, Inc.
g. Weksler Glass Thermometer Corp.
h. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum7-inch nominal size unless otherwise indicated.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

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

    a. Ametek U.S. Gauge.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab Inc.
    e. Marsh Bellofram.
    f. Miljoco Corporation.

g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. WATTS.
m. Weiss Instruments, Inc.
n. Weksler Glass Thermometer Corp.
o. WIKA Instrument Corporation.
p. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi .
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

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

1. IMI Flow Design, Inc.
2. Miljoco Corporation.
3. Nexus Valve, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. WATTS.
8. Weiss Instruments, Inc.
9. Weksler Glass Thermometer Corp.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

2.6 TEST-PLUG KITS

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

1. IMI Flow Design, Inc.
2. Miljoco Corporation.
3. Nexus Valve, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. WATTS.
8. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

L. Install pressure gages in the following locations:
1. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping:
1. 0 to 150 deg F.

B. Scale Range for Domestic Hot-Water Piping:

1. 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping:
1. 0 to 200 psi.

B. Scale Range for Domestic Water Piping:
1. 0 to 160 psi.

END OF SECTION 220519

SECTION 220523 - VALVES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

B. Equipment and components principally relevant to this section include:

1. Check Valves
2. Ball Valves
3. Circuit Setters
4. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL:

A. Furnish and install valves shown on the drawings, specified herein and/or necessary for the control and easy maintenance of all piping and equipment. All valves shall be first quality of approved manufacture, shall have proper clearances, and shall be tight at the specified test pressure. Each valve shall have the maker's name or brand, the figure or list number and the guaranteed working pressure cast on the body and cast or stamped on the bonnet or shall be provided with other means of easy identification. All valves shall be the product of one manufacturer except for special applications. Valves shall be Nibco, Hammond, or Fairbanks. Where figure numbers of one manufacturer are stated, equivalent figure numbers can be substituted.

B. Valves shall be of minimum working pressure and materials as fittings specified for the service except as herein modified. All gate and globe valves shall be suitable for repacking under pressure. Regardless of service, valves shall not be designed for less than 125 pounds per square inch steam working pressure.

C. All throttling valves shall have a means of indicating valve position.

2.2 CHECK VALVES

A. Screwed ends, Union Bonnets:

1. Bronze Checks 125# WSP

a. Hammond IB944
b. Nibco T-433-B
c. Fairbanks 0600

B. Solder Ends, Screwed Bonnets:

1. Bronze Checks 125# WSP

a. Hammond IB-945
b. Nibco S-433-B
c. Fairbanks 0680

C. Flanged Ends

1. Iron Checks 125# WSP

a. Hammond IR 1124
b. Nibco F-918-B
c. Fairbanks 0702

D. Swing check valves used as vacuum breakers: 15 degrees swing check, composition disc, 150 WSP: Nibco Fig T-433-Y or equal. Valves shall be 3/8" size.

2.3 CIRCUIT SETTERS

A. Circuit setters shall include brass balancing cock and taps for taking differential pressure readings. They shall be as manufactured by B&G, Taco, or Thrush.

2.4 BALL VALVES (2" AND BELOW)

1. Nibco T-595W
2. Jenkins 1100T
3. Crane or approved equal
4. Apollo

PART 3 - EXECUTION

3.1 GENERAL

A. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

C. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive installation.

D. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.

E. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.

F. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select, and install valves with the following ends or types of pipe/tube connections.

G. Tube Size 2" and Smaller: Soldered-joint valves.

H. Pipe Size 2" and Smaller: One of the following, at Installer's option:

1. Threaded valves
2. Grooved-end valves
3. Butt-welding valves
4. Socket-welding valves
5. Flanged valves
6. Flangeless valves
7. Single flanges valves

I. Pipe size 2-1/2" and larger: One of the following, at installer's option:

1. Grooved-end valves
2. Butt-welding valves
3. Socket-welding valves
4. Flanged valves
5. Wafer valves
6. Single flange valves
7. Hub-and-spigot valves
8. Mechanical joint end valves

J. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

K. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

L. Fluid Control: Except as otherwise indicated, install gate and ball valves to comply with ANSI B31.1.

M. Ball valves may be used in lieu of gate valves for equipment shut-off in size 2" and under.

N. Valves in positions where unauthorized closing could endanger safety or cause freeze-ups shall have wrench operation or lock shields and shall be marked with warning signs.

O. Ball valves and strainers shall be a minimum of the pipe size marked on the drawings. Reductions where necessary because of equipment or automatic valve size shall be made with the proper eccentric reducing fittings immediately adjacent to the inlet and outlet of the automatic valve. Bypasses for automatic valves shall be full size of the valve. Provide a service valve on either side of each piece of equipment.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

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

1. Buckaroos, Inc.
2. CADDY; brand of nVent Electrical plc.
3. Carpenter & Paterson, Inc.
4. National Pipe Hanger Corporation.
5. Pipe Shields Inc.
6. Piping Technology & Products, Inc.
7. Rilco Manufacturing Co., Inc.
8. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

    1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
15. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
16. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
17. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
18. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application at linkages of control devices.

C. Samples: For each type of insulation indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size**,** as well as ASTM standard designation and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule". articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

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

    a. Johns Manville; a Berkshire Hathaway company.
    b. Knauf Insulation.
    c. Manson Insulation Inc.
    d. Owens Corning.

2. Preformed Pipe Insulation: Type I, Grade A, with factory applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ramco Insulation, Inc.

C. Glass-Fiber and Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

C. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Mon-Eco Industries, Inc.
e. Vimasco Corporation.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
5. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Mon-Eco Industries, Inc.
2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to 180 deg F.
4. Color: White.

2.6 LAGGING ADHESIVES

A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Vimasco Corporation.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 20 to plus 180 deg F.
4. Color: White.

2.7 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Mon-Eco Industries, Inc.
    d. Owens Corning.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

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

    a. Childers Brand; H. B. Fuller Construction Products.

b. Foster Brand; H. B. Fuller Construction Products.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

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

a. Airex Manufacturing.
b. Johns Manville; a Berkshire Hathaway company.
c. P.I.C. Plastics, Inc.
d. Proto Corporation.
e. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

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

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

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

a. 3M Industrial Adhesives and Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

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

a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.
2. Stainless Steel: ASTM A240/A240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

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

a. C & F Wire.

b. Johns Manville; a Berkshire Hathaway company.
c. RPR Products, Inc.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, P-2 ADA LAVATORY:

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

a. Buckaroos, Inc.
b. Just Manufacturing.
c. McGuire Manufacturing.
d. MVG Molded Products.
e. Plumberex Specialty Products, Inc.
f. Truebro.
g. Zurn Industries, LLC.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures, P-2 ADA LAVATORY:

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

a. Truebro.
b. Zurn Industries, LLC.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents, unless otherwise approved by the Engineer-of-Record.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch-wide strips of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, two locations of

threaded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation is the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation is one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation is the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation is the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1-1/2” thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation is one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation is the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.

2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping, and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Annealed-Temper Copper Tube: ASTM B88, Type K.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. Wrought Copper Unions: ASME B16.22.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B32, lead-free alloys.

B. Flux: ASTM B813, water flushable.

C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

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

a. A.Y. McDonald Mfg. Co.
b. Capitol Manufacturing Company.
c. Central Plastics Company.
d. HART Industrial Unions, LLC.
e. Jomar Valve.
f. Matco-Norca.
g. WATTS.
h. Wilkins.
i. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

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

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca.
d. WATTS.
e. Wilkins.
f. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

B. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install valves according to the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

F. Install domestic water piping level without pitch and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

P. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

G. Press fittings are prohibited.

3.4 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for copper tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 ADJUSTING

A. Perform the following adjustments before operation:

   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Automatic water shutoff valve systems.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers for domestic water piping.
6. Outlet boxes.
7. Hose bibbs.
8. Drain valves.
9. Water-hammer arresters.
10. Flexible connectors.

B. Related Requirements:

1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.2 DEFINITIONS

A. FKM: A family of Fluro elastomeric materials defined by ASTM D1418.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers :

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

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Cash Acme, A Division of Reliance Worldwide Corporation.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

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

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Cash Acme, A Division of Reliance Worldwide Corporation.

c. Champion - Arrowhead.
d. Legend Valve & Fitting, Inc.
e. MIFAB, Inc.
f. WATTS.
g. Woodford Manufacturing Company.
h. Zurn Industries, LLC.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

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

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. FEBCO; A WATTS Brand.
c. WATTS.
d. Zurn Industries, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Size: ¾".
6. Design Flow Rate: 2 gpm.
7. Selected Unit Flow Range Limits: 6 gpm.
8. Pressure Loss at Design Flow Rate: 3 psig.
9. Accessories:

a. Valves: Ball type, on inlet and outlet.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valve Assemblies MV-2:

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

a. Acorn Engineering Company; a Division of Morris Group International.
b. Lawler Valve
c. Leonard Valve Company.
d. POWERS; A WATTS Brand.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed, thermostatically controlled, water mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded or solder joint inlets and outlet.
7. Accessories: Manual temperature override control, check stops on hot- and cold-water supplies, and automatic hot- and cold-water shutoff upon inlet supply failure.
8. Tempered-Water Setting: 120 deg F.
9. Tempered-Water Design Flow Rate: 20 gpm.
10. Pressure Drop at Design Flow Rate: 10 psig.
11. Valve Finish: Bronze.

B. Individual-Fixture, Water Tempering Valves MV-1:

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

    a. Acorn Engineering Company; a Division of Morris Group International.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company.
    d. POWERS; A WATTS Brand.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Connections: Threaded inlets and outlet.
7. Finish: Chrome plated.
8. Tempered-Water Setting: 80 deg F.
9. Tempered-Water Design Flow Rate: .5 gpm.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

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

    a. Keckley Company.
    b. Titan Flow Control, Inc.
    c. WATTS.
    d. Zurn Industries, LLC.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:

a. Strainers NPS 2 and Smaller: 0.033 inch.

7. Drain: Pipe plug.

2.6 OUTLET BOXES

A. Icemaker Outlet Boxes P-6:

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

   a. Guy Gray, IPS Corporation.
   b. LSP Products Group.
   c. Oatey.
   d. Sioux Chief Manufacturing Company, Inc.
   e. Water-Tite, IPS Corporation.

2. Mounting: Recessed.
3. Material and Finish: enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Accessory: Water hammer arrestor.
6. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

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

   a. AMTROL, Inc.
   b. Jay R. Smith Mfg Co; a division of Morris Group International.
   c. Josam Company.
   d. MIFAB, Inc.
   e. Precision Plumbing Products.
   f. Sioux Chief Manufacturing Company, Inc.
   g. WATTS.
   h. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 FLEXIBLE CONNECTORS

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

1. Flex-Hose Co., Inc.
2. Mason Industries, Inc.
3. Metraflex Company (The).

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.

B. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

C. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

D. Y-Pattern Strainers: For water, install on supply side of each pump.

E. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

F. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

G. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Automatic water shutoff valve systems.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Outlet boxes.
6. Trap-seal primer device.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220208 "Plumbing Identification and painting."

3.6 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hubless, cast-iron soil pipe and fittings.
   2. PVC pipe and fittings.
   3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

   1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
   2. Do not proceed with interruption of sanitary waste service without **Owner's** written permission.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation can withstand the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10 ft. head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

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

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark.
2. ASTM A888 or CISPI 301.

C. CISPI, Hubless-Piping Couplings:

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

a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Dallas Specialty & Mfg. Co.
d. Fernco Inc.
e. Ideal Clamp Products, Inc.
f. Josam Company.
g. Matco-Norca.

h. MIFAB, Inc.
i. Mission Rubber Company, LLC; a division of MCP Industries.
j. NewAge Casting.
k. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C1277 and CISPI 310.
3. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

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

a. AB & I Foundry; a part of the McWane family of companies.
b. ANACO-Husky.
c. Charlotte Pipe and Foundry Company.
d. Clamp-All Corp.
e. Dallas Specialty & Mfg. Co.
f. Ideal Clamp Products, Inc.
g. MIFAB, Inc.
h. Mission Rubber Company, LLC; a division of MCP Industries.
i. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C1277 and ASTM C1540.
3. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

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

1. Charlotte Pipe and Foundry Company.
2. GF Piping Systems.
3. JM Eagle; J-M Manufacturing Co., Inc.
4. Mueller Industries, Inc.
5. National Pipe and Plastic, Inc.
6. North America Pipe Corporation.
7. Rocky Mountain Colby Pipe Company.
8. Silver-line Plastics.

B. Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" marking for plastic sewer piping.

C. Solid-Wall PVC Pipe: ASTM D2665 drain, waste, and vent.

D. PVC Socket Fittings: ASTM D2665, made in accordance with ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F656.

F. Solvent Cement: ASTM D2564.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:

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

        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company, LLC; a division of MCP Industries.
        4) Plastic Oddities.

    b. Standard: ASTM C1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. End Connections: Same size as and compatible with pipes to be joined.
    e. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
        2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926 PVC.
        3) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

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

        1) Cascade Waterworks Mfg. Co.
        2) Mission Rubber Company, LLC; a division of MCP Industries.

    b. Standard: ASTM C1460.

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

5. Pressure Transition Couplings:

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

1) Apollo Valves; a part of Aalberts Integrated Piping Systems.
2) Cascade Waterworks Mfg. Co.
3) EBAA Iron, Inc.
4) Ford Meter Box Company, Inc. (The).
5) JCM Industries, Inc.
6) Romac Industries, Inc.

b. Standard: AWWA C219.
c. Description: Metal sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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

1) A.Y. McDonald Mfg. Co.
2) Capitol Manufacturing Company.
3) Central Plastics Company.
4) HART Industrial Unions, LLC.
5) Jomar Valve.
6) Matco-Norca.
7) WATTS.
8) Wilkins.
9) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drainpipe.

a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.

4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 1 percent downward in direction of flow.
3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.

N. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and Hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join Hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for Hubless-piping coupling joints.

B. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

C. Plastic, Non pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, no pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install individual, straight, horizontal piping runs:

    a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.

4. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
5. Base of Vertical Piping: MSS Type 52 spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

D. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220208 "Plumbing Identification and painting."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller are to be the following:
   1. Hubless, cast-iron soil pipe and fittings.
   2. Dissimilar Pipe-Material Couplings: Shielded, no pressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller is to be the following:
   1. Hubless, cast-iron soil pipe and fittings.
   2. Dissimilar Pipe-Material Couplings: Shielded, no pressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 and smaller are to be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. PVC installed below grade shall be installed in a proper bedding of sand per the pipe manufacturer's installation instructions.
   2. Dissimilar Pipe-Material Couplings: Unshielded, no pressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:
   1. Section 224500 "Emergency Plumbing Fixtures."

1.3 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts FCO:

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

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Tyler Pipe; a subsidiary of McWane Inc.
    e. WATTS.
    f. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Wall Cleanouts WCO:

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

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure Plug:

a. Brass.
b. Countersunk head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings FD-1:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. Air-Gap Fittings :

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device :

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Expansion Joints :

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Assemble open drain fittings and install with top of hub **1 inch** above floor.

E. Install deep-seal traps on floor drains and other waste outlets, if indicated.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

I. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220208 "Plumbing Identification and Piping."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

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. Commercial, light-duty, storage, electric, domestic-water heaters.
   2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial, electric, domestic-water heater.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: Three years.

b. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

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

    a. A. O. Smith Corporation.
    b. American Water Heaters.
    c. Bradford White Corporation.
    d. Heat Transfer Products, Inc.
    e. Hubbell Electric Heater Co.
    f. Lochinvar, LLC.
    g. Rheem Manufacturing Company.
    h. Ruud Water Heaters; a Rheem brand.
    i. State Industries.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 174.
4. Storage-Tank Construction: Steel, vertical arrangement.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

5. Factory-Installed, Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1.
    e. Jacket: Steel with enameled finish or high-impact composite material.
    f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    g. Heating Elements: Electric, screw-in immersion type.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Control: High-temperature-limit cutoff device or system.

j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

6. Special Requirements: NSF 5 construction with legs for off-floor installation.

B. Capacity and Characteristics:

1. See Drawings

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

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

a. A. O. Smith Corporation.
b. AMTROL, Inc.
c. Flexcon Industries.
d. Honeywell International Inc.
e. Pentair Pump Group.
f. State Industries.
g. Taco Comfort Solutions.

2. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
3. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tank.
4. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

5. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: 3.2 gal. minimum.
c. Air Pre-charge Pressure: 55 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic water heater and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

G. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

2.4 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. 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.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General Duty Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General Duty Valves for Plumbing Piping," for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill electric, domestic-water heaters with water.

J. Charge domestic-water expansion tanks with air to required system pressure.

K. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220208 "Plumbing Identification and Painting"

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters. Training shall be a minimum of one hour.

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor-mounted, bottom-outlet water closets.
2. Toilet seats.

1.2 DEFINITIONS

A. Standard-Efficiency Flush Volume: 1.6 gal. per flush.

B. High-Efficiency Flush Volume: 1.28 gal. or less per flush.

C. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 2 of each type.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
3. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
4. Comply with ICC A117.1 for ADA-compliant water closets.
5. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous china water closets to sanitary drainage systems.
6. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets - Floor Mounted, Bottom Outlet, Close-Coupled Flushometer Tank: P-1.

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

    a. American Standard.
    b. Kohler Co.
    c. Zurn Industries, LLC.

2. Source Limitations: Obtain water closets from single source from single manufacturer.
3. Bowl:

    a. Material: Vitreous china.
    b. Type: Siphon jet.
    c. Style: Flushometer tank, pressure assisted.
    d. Height: ADA compliant.
    e. Rim Contour: Elongated.
    f. Water Consumption: 1.28 gal. per flush.
    g. Color: White.

2.3 TOILET SEATS

A. Toilet Seats:

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

    a. American Standard.
    b. Bemis Manufacturing Company.
    c. Church Seats; Bemis Manufacturing Company.
    d. Kohler Co.
    e. Zurn Industries, LLC.

2. Source Limitations: Obtain toilet seat from single source from single manufacturer.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.
10. Surface Treatment: Antimicrobial.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

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

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.

B. Install toilet seats on water closets.

C. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

D. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13 - COMMERCIAL LAVATORIES

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. Vitreous china, wall-mounted lavatories.
2. Automatically operated lavatory faucets.
3. Supply fittings.
4. Waste fittings.
5. Lavatory supports.

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 lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory

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

a. American Standard.
b. Kohler Co.
c. Sloan Valve Company.
d. Zurn Industries, LLC.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Slab or wheelchair.
c. Nominal Size: Rectangular, 20 by 18 inches.
d. Faucet-Hole Punching: Three holes, 4-inch centers.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting: For concealed-arm carrier.

3. Faucet: "Automatically Operated Lavatory Faucets".

4. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
5. Lavatory Mounting Height: Handicapped/elderly in accordance with ICC A117.1.

2.2 AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an

American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Automatic Type: Battery Powered Electronic Sensor Operated, Nonmixing:

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

    a. American Standard.
    b. Kohler Co.
    c. Moen Incorporated.
    d. Sloan Valve Company.
    e. Zurn Industries, LLC.

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. 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.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punching; coordinate outlet with spout and fixture receptor.

5. Body Type: 3 Hole.
6. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate:0.35 gpm.
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.

11. Spout Outlet: Aerator.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type, or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 3/8.
2. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/4.
2. Material:

a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.5 LAVATORY SUPPORTS

A. Lavatory Carrier:

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

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. Wade; a subsidiary of McWane Inc.
d. WATTS.
e. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

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

3.2 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

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. Service sinks.
2. Break sinks.
3. Exam sinks.
4. Manually operated sink faucets.
5. Automatically operated sink faucets.
6. Supply fittings.
7. Waste fittings.
8. Grout.

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 sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Servicing and adjustments for automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks – Floor Mounted Terrazzo

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

    a. Acorn Engineering Company; a Division of Morris Group International.
    b. Fiat Products.
    c. Florestone Products Co., Inc.
    d. Stern-Williams Co., Inc.

2. Source Limitations: Obtain sinks from single source from single manufacturer.
3. Fixture:

    a. Material: Marble chips cast in Portland cement to produce a compressive strength of not less than 3000 psi, seven days after casting.
    b. Shape: Square.
    c. Nominal Size: 32 by 32 inches.
    d. Height: 12 inches with dropped front.

    e. Tiling Flange: Not required.

    f. Rim Guard: On all top surfaces.
    g. Color: Not applicable.
    h. Drain: Grid with NPS 3 outlet.
    i. Accessories: Mop Hanger, Hose Bracket and Wall Guards.

4. Mounting: On floor and flush to wall.

5. Faucet: Insert service sink faucet designation from "Manually Operated Sink Faucets" Article.

2.2 BREAK SINKS

A. Kitchen/Utility Sinks - Stainless Steel, Counter Mounted.

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

    a. Advance Tabco.
    b. Elkay.
    c. Just Manufacturing.

2. Source Limitations: Obtain sinks from single source from single manufacturer.
3. Fixture:

    a. Standard: ASME A112.19.3/CSA B45.4.
    b. Type: Stainless steel, self-rimming, sound-deadened unit less ledge back.
    c. Number of Compartments: One.
    d. Overall Dimensions: 25”x22”x10 3/8”.
    e. Material: 18-gauge, Type 304 stainless steel.

    f. Compartment:

        1) Dimensions: 21”x15 ¾”.
        2) Drain: Grid with NPS 1-1/2 tailpiece and twist drain.
        3) Drain Location: Centered in compartment.
        4) Depth: 10”.

4. Faucet(s): "Manually Operated Sink Faucets" Article.

    a. Number Required: One.
    b. Mounting: On ledge.

5. Supply Fittings:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

        1) Operation: Loose key.
        2) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

6. Waste Fittings:

    a. Standard: ASME A112.18.2/CSA B125.2.

b. Trap(s):

1) Size: NPS 1-1/2.
2) Material: Chrome Plated Brass.

a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

c. Continuous Waste:

1) Size: NPS 1-1/2.
2) Material: Chrome-plated, 17-gauge brass tube.

7. Mounting: On counter with sealant.

2.3 EXAM SINKS

A. Handwash Sinks - Stainless Steel: Drop-in

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

a. Advance Tabco.
b. Elkay.
c. Just Manufacturing.

2. Source Limitations: Obtain sinks from single source from single manufacturer.
3. Fixture:

a. Standards:

1) ASME A112.19.3/CSA B45.4.
2) NSF 61.

b. Type: Countertop-**mounted** stainless-steel sink with radius corners, and Countertop mounting brackets.
c. Overall Dimensions: 19 by 18 by 5 1/2 inches.

d. Material: 18-gauge, Type 304 stainless steel.

4. Faucet: "Automatically Operated Sink Faucets".
5. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
6. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

7. Mounting Height: Accessible in accordance with ICC A117.1.

2.4 MANUALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Commercial Sink Faucets - Manual Type: Single-handle mixing.

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

    a. Elkay.
    b. Just Manufacturing.
    c. Speakman Company.
    d. Zurn Industries, LLC.
    e. Fiat Products.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punching; coordinate outlet with spout and sink receptor.

5. Body Type: Centerset.
6. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Polished chrome plate.

8. Maximum Flow Rate: 1.5 gpm.
9. Mounting Type: Deck, exposed.
10. Valve Handle(s): Lever handle.
11. Spout Type: Swivel.

12. Vacuum Breaker: Not Required.
13. Spout Outlet: Laminar flow aerator.

C. Commercial Service Sink Faucets - Manual Type: Two Handle Mixing.

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

    a. Fiat Products.
    b. Stern-Williams Co., Inc.
    c. T&S Brass and Bronze Works, Inc.
    d. Zurn Industries, LLC.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.

3. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.
4. Faucet:

    a. Standards:

        1) ASME A112.18.1/CSA B125.1.
        2) NSF 61 and NSF 372.
        3) ICC A117.1.
        4) ASSE 1001 (VB).

    b. Finish: Polished chrome plated.
    c. Handles: Lever.
    d. Cartridges: One-fourth turn compression.
    e. Brace: Adjustable top brace.

2.5 AUTOMATICALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Commercial Sink Faucets - Automatic Type: Battery-powered, electronic-sensor-operated, mixing.

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

    a. Elkay.
    b. Just Manufacturing.
    c. Speakman Company.
    d. Zurn Industries, LLC.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
4. 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.
5. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punching; coordinate outlet with spout and fixture receptor.

6. Body Type: Single hole.
7. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
8. Finish: Chrome plated.

9. Maximum Flow Rate: 1.5 gpm.
10. Mounting Type: Deck.
11. Spout Type: Rigid, gooseneck.
12. Spout Outlet: Aerator.
13. Thermostatic Mixing Valve: Below deck, single temperature, with check valves.
14. Control Module: Below deck, water-resistant module with internal flow setting switches.
15. Drain: Not part of faucet.

2.6 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type, or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 3/8.
2. ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

2.7 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material:

    a. Chrome-plated, two-piece, cast-brass trap, and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

2.8 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non shrink; recommended for interior and exterior applications.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

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

3.2 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.

B. Set floor-mounted sinks in leveling bed of cement grout.

C. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping".
2. Install stops in locations where they can be easily reached for operation.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

E. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.4 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Eyewash equipment.
   2. Supplemental equipment.
   3. Water-tempering equipment.

1.2 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Portable, Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid supply.

D. Tepid: Between 60 and 100 deg F.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings:

   1. Plans, elevations, sections, and mounting details.
   2. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   4. Diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Submittals:

   1. Field quality-control reports.

B. Emergency fixture third-party certification documentation.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ANSI/ISEA Z358.1 for emergency plumbing fixtures including third-party certification of fixtures.

B. Comply with ASSE 1071 for temperature-actuated mixing valves for plumbed emergency fixtures.

C. Comply with ASME A112.18.1/CSA B125.1 for water-supply fittings.

D. Comply with ASME A112.18.2/CSA B125.2 for plumbing waste fittings.

E. Comply with NSF 61 and NSF 372 for fixture materials that will be in contact with potable water.

F. Comply with requirements in ICC A117.1 for plumbing fixtures for people with disabilities.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SUPPLEMENTAL EQUIPMENT

A. Drench Hoses - Deck Mounted, Plumbed

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

a. Acorn Safety; a Division of Morris Group International.

b. Bradley Corporation.
c. Encon Safety Products.
d. Guardian Equipment Co.
e. Speakman Company.
f. WaterSaver Faucet Co.

2. Source Limitations: Obtain drench hoses, deck mounted, plumbed, from single manufacturer.
3. Capacity: Not less than 0.4 gpm for at least 15 minutes.
4. Supply Fitting: NPS 1/2 brass with flow regulator.
5. Drench Hose: Handheld spray head with squeeze-handle actuation and hose.
6. Mounting: In hole on deck.
7. Drench hose shall comply with ANSI Z358.1 as a dual drench hose/eyewash.

2.3 WATER-TEMPERING EQUIPMENT

A. Water-Tempering Equipment - Hot and Cold Water.

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

a. Acorn Safety; a Division of Morris Group International.
b. Armstrong International, Inc.
c. Bradley Corporation.
d. Guardian Equipment Co.
e. Haws Corporation.
f. Lawler Manufacturing Company, Inc.
g. Leonard Valve Company.
h. Speakman Company.
i. Stingray Systems LLC.
j. WaterSaver Faucet Co.
k. WATTS.

2. Source Limitations: Obtain water-tempering equipment, hot and cold water, from single manufacturer.
3. Description: Factory-fabricated equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
b. Supply Connections: For hot and cold water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

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

3.2 INSTALLATON OF EMERGENCY PLUMBING FIXTURE

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures, to facilitate maintenance of equipment. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping."

1. Exceptions:
    a. Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

3.3 PIPING CONNECTIONS

A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 221116 "Domestic Water Piping."

B. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220208 "Plumbing Identification and Painting."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Operate and adjust emergency plumbing fixtures and controls. Replace damaged and malfunctioning fixtures and controls.

B. Adjust or replace fixture flow regulators for proper flow.

C. Adjust equipment temperature settings.

3.7 CLEANING AND PROTECTION

A. Clean emergency plumbing fixtures with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed emergency plumbing fixtures and fittings.

C. Do not allow use of emergency plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224500

SECTION 229000 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RECORD DRAWINGS - BUILDING:

A. Submit as-built drawings as required by General Conditions and obtain written receipt from engineer.

1.2 DEMONSTRATION OF COMPLETE PLUMBING SYSTEMS:

A. The following systems shall be put into operation by the plumbing sub-contractor furnishing the equipment and operated for the length of time required to prove proper operation and control.

1. Cold Water
2. Hot water systems/recirculation systems
3. Waste

B. Thoroughly demonstrate and instruct (3) three designated representatives of the Owner in the care and operation of all the plumbing systems and equipment furnished and installed in the contract.

C. Manufacturers of certain equipment specified herein shall provide technically qualified factory representatives to train the Owner's representative in the care and maintenance and operation of their product. This instruction and service of the factory representative shall be furnished as specified elsewhere in the specifications. This time is in addition to what is specified above and will not be counted as part of this contractor's instructions.

D. The time and place of all training shall be coordinated and scheduled by the contractor at the convenience of the Owner and as approved by the architect.

E. Submit letters signed by the owner's representatives attesting to the satisfactory completion of all instructions.

1.3 OWNER'S RIGHT TO TEST SYSTEM:

A. Should, in the opinion of the architect, and during the guarantee period, reasonable doubt exists as to the proper functioning of any equipment installed under this contract, the right is reserved for the owner and architect to perform any test deemed practical to determine whether such equipment is functioning properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the owner. If the tests indicate a deficiency in equipment capacity or performance, the contractor shall pay the cost of the test and make good any deficiencies shown by the test to the full satisfaction of the owner and the architect.

1.4 OPERATING AND MAINTENANCE MANUALS:

A. The contractor shall carefully prepare an operating instructions and maintenance manual for each plumbing system, including all equipment furnished. The manual shall be submitted to the engineer for approval before final inspection and acceptance is made.

B. The form in which the operating maintenance manual is to be presented shall be subject to approval by the architect. Three copies of the manual shall be provided.

C. The following items together with any other necessary and pertinent data shall be included in the manual. This list is not necessarily complete and is only to be used as a guide.

1. Suggested settings of all control and switches for normal operation with description of control and its location.
2. A check list for periodic maintenance of all equipment.
3. As-built wiring, interlock, and control diagrams for the equipment, with color coding shown on wiring and interlock diagrams.
4. Part numbers of all replaceable items.
5. Manufacturer's cuts and rating tables for all equipment.
6. Oiling, lubricating and greasing data.
7. Complete electrical load data from operation tests.
8. Test data on all equipment
9. Serial number of all principal pieces of equipment
10. Valve tag schedule
11. Manufacturers', suppliers', and contractors' names, addresses and telephone numbers.

1.5 VALVE TAG SCHEDULE:

A. Copies of the valve tag schedule and wiring diagrams shall be framed under glass and posted in the equipment room.

1.6 WARRANTIES:

A. Deliver to Owner all warranties, etc., and obtain written receipts.

1.7 OBSERVATION REPORTS:

A. During construction period the engineer will issue observation reports. These items shall be completed before engineer will approve next application for payment. Final punch list work shall be complete before acceptance.

1.8 FINAL INSPECTION AND ACCEPTANCE:

A. The architect or his authorized representative will entertain the request for final inspection and acceptance only after the following items are done.

1. Submit a list of uncompleted items, if any, and advise when the items will be done.
2. Clean, test, and adjust all systems and equipment.
3. Lubricate all motors.
4. Complete all items on architect's or engineer's pre-final punch list.
5. Final inspection and tests of the completed construction shall be performed in the presence of the architect or his representative and shall be at such times as are convenient to the architect. Final tests shall show conclusively that all equipment performs its intended and specified function and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for these tests shall be furnished by the contractor at his own expense.
6. Final Clean-up. During construction the contractor shall keep the site clear of debris and upon completion of construction he shall clean up the premises to remove all evidence of his work. In addition, upon completion of construction he shall clean, wash, and/or polish all fixtures, equipment, and exposed material and leave them bright and clean.

END OF SECTION 229000

TABLE OF CONTENTS

DIVISION 23 - MECHANICAL

SECTION 230100 – GENERAL PROVISIONS – MECHANICAL
SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC
SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
SECTION 230713 - DUCT INSULATION
SECTION 230719 - HVAC PIPING INSULATION
SECTION 232113 - REFRIGERANT, CONDENSATE PIPE AND PIPE FITTINGS
SECTION 233113 - METAL DUCTS
SECTION 233300 - AIR DUCT ACCESSORIES
SECTION 233416 - CENTRIFUGAL HVAC FANS
SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES
SECTION 237070 – PACKAGED ROOFTOP HEATING AND COOLING UNITS
SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONING UNITS
SECTION 239000 – PROJECT CLOSEOUT
SECTION 239800 – TESTING AND BALANCING SYSTEMS
SECTION 239850 – SYSTEM TESTING, CLEANING AND START-UP
SECTION 239860 – OPERATION AND MAINTENANCE DATA
SECTION 239900 – COMMISSIONING OF MECHANICAL SYSTEMS

SECTION 230100 – GENERAL PROVISIONS - MECHANICAL

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The work to be done under Division 23 contract shall include the furnishing of all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all work as shown on the plans and herein specified, excepting only work materials specified or noted as being furnished or installed by others.

B. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotation.

C. The Mechanical Contractor may hereinafter also be referred to as "This Contractor," "Contractor," HVAC Contractor M.B.C, M.B.C. Contractor, "MC", Division 23 Contractor, or "MECH."

D. Drawings shall not be scaled.

1.2 WORK INCLUDED:

A. The Mechanical Contractor shall be responsible for including all labor, accessories, tools, equipment and material required to completely execute installation of the entire heating, and air conditioning system as shown on the drawings and as specified. Work under the Mechanical contract shall include but not be limited to the furnishing, unloading, handling distribution, setting and installation of all components required for the following systems:

1. Temperature Control Systems
2. Condensate Drainage Systems
3. Duct Liner and Insulation
4. Air Distribution Systems and Devices
5. Exhaust Systems
6. Refrigerant Piping
7. Refrigerant Piping Insulation
8. Split Dx Cooling Units
9. Testing, Adjusting and Balancing
10. Other Work as Herein Specified

1.3 RELATED WORK WHICH IS A PART OF SECTION 230100:

A. All work done under this section of the specification is subject to the Engineer's instructions to bidders, general conditions and their corresponding supplements.

B. Refer to the supplementary general conditions of these specifications for temporary services and facilities that shall be provided.

1.4 DEFINITIONS:

A. "Ductwork": All air delivery, recirculation and exhaust ducts, whether of sheet metal or other material, and includes all connections, accessories, and appurtenances necessary for and incidental to a complete system.

B. "Provide" (P): Furnish and install complete ready for use.

C. "Furnish" (F): Purchase and deliver to the project site complete with every necessary appurtenance and support.

D. "Install"(I): Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation of the proper location in the project.

E. "Concealed": Embedded in masonry or other construction, installed behind wall furring, within double partitions or hung ceilings, in crawl spaces, in shafts.

F. "By other Trades": Shall mean by persons or parties who are not anticipated to be the contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.5 ABBREVIATIONS:

1.	AD	Automatic Damper/Access Door
2.	AMP	Amperes
3.	AP	Access Panel
4.	AV	Air Vent
5.	CD	Ceiling Diffuser
6.	CO	Clean Out
7.	CONTR	Contractor
8.	DB	Decibels
9.	DIS.SW.	Disconnect Switch
10.	DN	Down
11.	EA	Exhaust Air
12.	EF	Exhaust Fan
13.	EG	Exhaust Grille
14.	ELEC	Electrical
15.	F	Furnish or Filter
16.	G	Grille
17.	LSPA	Low Pressure Supply Air
18.	MSPA	Medium Pressure Supply Air
19.	NC	Noise Criteria
20.	OTH	By Other Trades
21.	P	Provided (Furnished and Installed)

22.	PLBG	Plumbing
23.	RA	Return Air
24.	RG	Return Grille
25.	RR	Return Register
26.	SA	Supply Air
27.	SD	Slot Diffuser
28.	SG	Supply Grille
29.	SP	Static Pressure
30.	SR	Supply Register
31.	T	Thermostat
32.	PH	Current Phase

1.6 INTERPRETATION OF CONTRACT DOCUMENTS:

A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

B. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are that notes on the drawings, which refer to an individual element of work, take precedence over the specifications where they conflict with same.

C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

D. The drawings of necessity utilize symbols as schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.

G. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.7 DELINEATION OF WORK:

A. The contract is required to supply all necessary supervision and coordination of information to any others who are performing work.

B. The Specifications for the overall construction delineate various items of work under separate section headings. The list below set forth this delineation to the extent that it affects the Mechanical work category. In the absence of more detailed information, this list shall be taken as a specific instruction to the Mechanical Contractor to include the work assigned to him. Indications that each contractor is to perform the work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

"P" indicates Provide
"F" indicates Furnish
"I" indicates Install

Item	"Other"	"Plbg"	"Mech"	"Elect"
Hoisting			P	
Rigging			P	
Cutting and patching			P	
Framed slots and openings in walls	I		F	
Decks and slabs			P	
Sleeves through slabs, decks and walls	I		F	
Fastenings			P	
Supports			P	
Field touch-up painting damaged shop coats			P	
Finish painting of exposed work			P	
Finished wall and ceiling access doors, panels & support frames	I		F	
Rubbish removal			P	
Duct smoke detectors			I	F

1.8 STANDARDS AND CODES:

A. Nothing in this specification shall be interpreted to conflict with any City or State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.

B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction."

C. All equipment with electrical components shall bear the UL label.

D. The following minimum standards apply wherever applicable:

1.	ANS	American National Standards
2.	ASME	American Society of Mechanical Engineers
3.	ASTM	American Society for Testing Materials
4.	NEMA	National Electrical Manufacturers Association
5.	NFPA	National Fire Protection Association
6.	OSHA	Occupational Safety and Health Act
7.	SMACNA	Sheet Metal and Air Conditioning Contractors National Assoc., Inc
8.	ASA	American Standards Association
9.	AWWA	American Water Works Association
10.	NBFU	National Board of Fire Underwriters
11.	OSHA	Occupational Safety and Health Act

1.9 INSPECTION AND COOPERATION:

A. All work shall be done under the periodic observation of and to the complete satisfaction of the Engineer. No deviations from the Drawings and Specifications will be allowed without prior written approval of the Engineer. The mechanical contractor shall each cooperate with the other contractors to allow for the installation of their work as well as his own.

B. The mechanical contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this Sub-contractor without regard for other work, or if a conflict results, must be changed if directed by the Architect or Engineer without additional cost to Owner or his agents.

C. Relocation of equipment, system connections or rough-in locations up to ten feet (10'), if necessary, shall be done at no additional cost to the Owner or his agents if done before roughing-in.

D. All concealed work shall be inspected by the Engineer or his appointed representative before being concealed. Mechanical contractor shall each call for inspection at least two (2) work days before concealment.

E. The Engineer shall have the right to inspect the work whenever advisable in his judgment.

F. Recommendations made by the Engineer shall be promptly carried out and all unsatisfactory material and workmanship replaced at once to the Engineer's satisfaction at the appropriate contractor expense.

G. The mechanical contractor shall be responsible for hoisting of all materials and equipment furnished under as part of his portion of the work in accordance with all City, State, and Federal rules and regulations.

1.10 TEMPORARY SERVICES AND FACILITIES:

A. Refer to general requirements for temporary services and facilities that shall be provided.

1.11 CONTRACTORS EMPLOYEES:

A. All employees on the project site shall comply with the local regulations regarding Licenses.

1.12 UNIT PRICES:

A. Refer to general requirements relative to "Add" or "Deduct" prices relative to this contract.

1.13 SUBMITTALS:

A. LIST OF MANUFACTURERS: Within thirty days following award of contract, the mechanical contractors shall submit the required information pertaining to the equipment and materials he will be furnishing, commencing with the list of manufacturers for approval by the Engineer. Following up in short order shall be the shop drawings and other documents. The Owner and his representatives reserve the right to reject as unacceptable any items for which, in their judgment, they have not been allowed adequate lead time in which to investigate suitability, or their experience has proved the service or equipment unsatisfactory.

1.14 SHOP DRAWINGS:

A. Prior to purchasing any equipment or materials, the approved list of the manufacturers shall be returned by the Engineer to the Contractor.

B. Shop drawings shall be submitted conforming to the requirements stated in supplementary conditions and Division 01 for the items indicated throughout the following specifications:

C. Documents will not be accepted for approval unless:

1. They comply with the requirements of the supplement to the General Conditions.
2. They include complete information pertaining to appurtenances and accessories.
3. They are submitted as a package where they pertain to related items.

4. They are properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable and are marked with pertinent specification paragraph number.
5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.
6. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

1.15 AS-BUILT DRAWINGS:

A. This contractor shall provide one set of marked plans to the Engineer for his preparation of as-built drawings. The marked plans shall indicate correct dimensioned location of all equipment, piping, etc. as installed on project. Schedules shall be updated to indicate the actual installed equipment.

B. The drawings shall provide an accurate and complete record of the work as installed.

PART 2 - PRODUCTS

2.1 MATERIALS AND MANUFACTURERS:

A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriter Laboratories approval where subject to Underwriters Laboratory label service. Where no specific indication as to the type of material or equipment is indicated a first-class standard article shall be furnished.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. It is the intent of the specifications that wherever manufacturers of a product are specified any substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

C. Substituted equipment, where permitted or approved, must conform to space requirements, whether approved or not or shall be replaced at the contractor's expense. Any modification of related systems as a result of substitutions shall be made at the contractor's expense.

D. Note the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, or any other Owner's

Representative, attests to the dimensional accuracy or the ability of the material or equipment involved or the mechanical performance of the equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

2.2 SUBSTITUTION OF SPECIFIED MATERIALS:

A. It is the purpose of this specification not to exclude competition between manufacturers of similar equipment.

B. Where items are specified as "or approved equivalent" prior approval must be obtained from the Engineer. Said approval does not intend to obligate the Engineer in the event shop drawings submitted do not indicate equality of materials, workmanship or function and the right to reject substitutes shall remain the prerogative of the Engineer.

C. In all cases regardless of method of submission, the contractor shall be completely responsible for changes in dimension of other than first named manufacturer equipment, electrical changes, etc. required for proper function and final performance. Any changes required in the electrical wire, wiring, conduits, switches or breakers shall be borne by the Mechanical Contractor without an increase in price to the Owner. Item shall comply with all requirements herein set forth and as required to perform as designed. Minor modifications to suit standard manufactured items are acceptable if approved by Engineer.

D. Should contract documents fail to describe particular materials or goods to be used, then it shall be the duty of contractor to inquire of Engineer as to what is to be used and to supply it at contractor's expense or else thereafter or to require corrections.

E. Mechanical contractor shall promptly remove, at own expense, rejected materials from site of work.

F. When material has been approved, no change in brand or make will be permitted without approval of Engineer.

2.3 NAMEPLATES:

A. All items of operation equipment used on the project shall be provided with a nameplate mounted in a conspicuous place on the unit. Plate shall be embossed metal or stamped metal securely fastened to the unit.

B. The plate shall contain the following information:

1. Manufacturer's name and address.
2. All approval stamps, AGA, UL, etc. as hereinafter specified.
3. Complete capacity and operating data as approved by Engineer
4. Motor Characteristics, voltage, phase, amperage.
5. Serial number and code numbers
6. Date of manufacture

PART 3 - EXECUTION

3.1 WORKMANSHIP:

A. Workmanship shall be of best quality. Good appearance of finished work shall be of equal importance with its mechanical efficiency. No make-shifts shall be permitted anywhere in work and all portions work shall be so laid out and installed that work as a whole is of uniform quality and appearance.

3.2 PROTECTION OF EQUIPMENT:

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period.

B. Protection from damage from rain, dirt, sun and ground water shall be accomplished by storing the equipment on elevated supports and covering them on all sides with protective rigid or flexible water proof coverings securely fastened.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable material to prevent dirt accumulation in the piping.

D. This contractor shall be responsible for the work damaged by him in executing this contract. Any work damaged by the Mechanical Contractor shall be replaced by him and placed in perfect condition without extra cost.

3.3 CONTIGUOUS WORK:

A. If any part of the mechanical contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the contractor shall examine and measure such contiguous work and report to the Engineer in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible.

3.4 CERTIFICATES OF INSPECTION AND APPROVAL:

A. Upon completion of work, mechanical contractor shall each furnish to the Owner certificates of inspection or approval from the authorities having jurisdiction if certificates of inspection or approval are required by law or regulation.

3.5 SLEEVES AND OPENINGS:

A. All sleeves and openings required shall be located and provided by the contractor for his portion of the work.

3.6 ACCESS TO EQUIPMENT AND VALVES:

A. All control devices, specialties, valves and removable panels on equipment shall be so located as to provide easy access for inspection and maintenance, including removal of any interior components.

B. Should any work, such as piping, ducts, conduit, etc. be installed without due regard to the accessibility of devices installed by this contractor the installation shall be relocated, offset or rerouted without cost to the Owner.

3.7 COORDINATION:

A. The mechanical contractor is cautioned that the space is limited. Offset ducts and piping as required at no additional cost.

B. The mechanical contractor shall coordinate the work of his trade and other trades in order that interference between mechanical, electrical, work will be avoided. Piping, ducts, conduits, etc. shall be kept as close as possible to overhead structure, walls, columns, etc. in order to take up the minimum amount of space; and all offsets, fittings, etc. required shall be furnished without additional cost to the Owner. In case interferences develop, the Engineer will decide which equipment shall be relocated regardless of which was first installed.

C. Minor changes required by Owner, and any incidental changes required to meet structural conditions or to match trim etc. shall be made by this contractor without extra cost to the Owner. Generally, all pipes, and conduits except those in the equipment room and in other locations specifically designated on the plans shall be run concealed in furrings and chases. In the event that it is necessary to expose these items in finished areas, this shall be called to the Engineer's attention before proceeding with the work.

D. The Mechanical contractor shall cooperate closely with all other contractors on the job in order that the job will progress smoothly to its completion.

E. All equipment shall be installed with sufficient access and clearance for maintenance, repairs, and replacement. In the event that it appears necessary to install equipment without proper access or clearance, the work shall be stopped until written permission is received from the Engineer to install the equipment. Ducts shall be installed in such a way as to allow maximum headroom where ducts are in occupied areas. Where controls, fire dampers, etc. are installed in inaccessible areas, provide steel access panels. The panels shall be sufficiently large for the servicing of the equipment involved, or 12" x 12" minimum size. Panels installed in plaster surfaces shall have plaster ground and fit flush in the plaster.

3.8 CUTTING AND PATCHING:

A. The cutting of openings or holes in walls shall be done in a manner as not to endanger the stability of the structure or any part thereof.

END OF SECTION 230100

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC 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. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

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

1. Advance Products & Systems, Inc.

2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anti-corrosion coated or zinc coated, with plain ends and integral welded waterstop collar.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

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

1. Jay R. Smith Mfg Co; a division of Morris Group International.
2. Zurn Industries, LLC.

B. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral cast flashing flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. Airex Manufacturing.
3. CALPICO, Inc.
4. GPT; an EnPro Industries company.
5. Metraflex Company (The).
6. Proco Products, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description:

1. Manufactured plastic, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.
2. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, use NT.

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

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation.
c. Permathane®/Acryl-R®; ITW Polymers Sealants North America.
d. Polymeric Systems, Inc.
e. Sherwin-Williams Company (The).
f. The Dow Chemical Company.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Smooth-On.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide **1-inch** annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
2. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
3. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
4. Using waterproof silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated, Horizontal Assembly, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeve-seal fittings.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs Above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

3. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

END OF SECTION 230517

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
3. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following. Include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of **copper-plated steel**.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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

    a. ABB, Electrification Business.
    b. Cooper B-line; brand of Eaton, Electrical Sector.
    c. Flex-Strut Inc.
    d. G-Strut.
    e. Haydon Corporation.
    f. MIRO Industries.
    g. Unistrut; Atkore International.
    h. Wesanco, Inc.

2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with in-turned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
8. Metallic Coating: No coating.

B. Non-MFMA Manufacturer Metal Framing Systems:

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

    a. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
    b. CADDY; brand of nVent Electrical plc.
    c. Carpenter & Paterson, Inc.

d. Eberl Iron Works, Inc.
e. Empire Industries, Inc.
f. Gripple Inc.
g. MIRO Industries.
h. PHD Manufacturing, Inc.
i. RectorSeal HVAC; a CSW Industrials Company.

2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with in-turned lips.
5. Channel Width: Select for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
8. Metallic Coating: No coating.

2.5 THERMAL-HANGER SHIELD INSERTS

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

1. Buckaroos, Inc.
2. CADDY; brand of nVent Electrical plc.
3. Carpenter & Paterson, Inc.
4. KB Enterprise.
5. National Pipe Hanger Corporation.
6. Pipe Shields Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psi minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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

a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.
d. Simpson Strong-Tie Co., Inc.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Empire Tool and Manufacturing Co., Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
e. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated steel.
3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 OUTDOOR EQUIPMENT STANDS

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

1. Eberl Iron Works, Inc.
2. MIRO Industries.
3. RectorSeal HVAC; a CSW Industrials Company.

4. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components,

without roof membrane penetration, in a pre-fabricated system that can be modularly-assembled on site.

5. Foot Material: Rubber or polypropylene.
6. Rails Material: Hot dip galvanized carbon steel.
7. Wind/Sliding Load Resistance: Up to 100 mph minimum.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 300 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners o] mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

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. Spring hangers.
   2. Restraints - rigid type.
   3. Restraint accessories.
   4. Post-installed concrete anchors.
   5. Concrete inserts.

1.3 DEFINITIONS

A. IBC: International Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

   2. Include load rating for each wind-force-restraint fitting and assembly.

B. Shop Drawings:

   1. Detail fabrication and assembly of equipment bases.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal:

   1. For each wind-load protection device, including concrete anchor and insert, and restrained isolation roof-curb rail that is required by this Section or is indicated on Drawings, submit the following:

a. Wind-Load Restraint, and Vibration Isolation Base Selection: Select vibration isolators, and wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
d. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
e. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.

2. Wind Restraint Detail Drawing:

a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

3. All delegated-design submittals for wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
4. Product Listing, Preapproval, and Evaluation Documentation: By FM Approvals, showing maximum ratings of restraint items and basis for approval (tests or calculations).
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Air-Spring Isolator Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

E. Field quality-control reports.

F. Wind-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-force performance certification.

1. Provide equipment manufacturer's written certification for each designated HVAC device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
2. Provide manufacturer's written certification for each designated louver, damper, or similar device, stating that it will remain in place and protect opening from penetration of windborne debris and comply with all requirements of authorities having jurisdiction.
3. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

4. The following HVAC systems and components require special certification for high wind performance. Written special certification of resistance to the effects of high wind force and impact damage must be provided by manufacturer:

    a. Rooftop Mounted Condenser Units.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. **Wind-Load** Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by FM Approvals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wind load control system.
   1. Wind-Load Performance: Equipment shall withstand the effects of high wind events determined in accordance with ASCE/SEI 7-05.

B. Wind-Load Design Calculations:

   1. Perform calculations to obtain force information necessary to properly select wind-load-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-05. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise noted.

      a. Data indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.

   2. Design wind pressure "p" for external sidewall-mounted equipment such as louvers is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-16, Ch. 30. Perform calculations in accordance with one of the following, as applicable:

      a. Low-Rise Buildings.

C. Double-Deflection, Elastomeric Isolation Mounts:

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

      a. Ace Mountings Co., Inc.
      b. CADDY; brand of nVent Electrical plc.
      c. California Dynamics Corporation.
      d. Isolation Technology, Inc.
      e. Kinetics Noise Control, Inc.
      f. Korfund.
      g. Mason Industries, Inc.
      h. Novia; A Division of C&P.
      i. Vibration Eliminator Co., Inc.
      j. Vibration Isolation.
      k. Vibration Management Corp.
      l. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

    a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
    b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil- and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.

2.2 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

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

    a. Ace Mountings Co., Inc.
    b. CADDY; brand of nVent Electrical plc.
    c. California Dynamics Corporation.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Novia; A Division of C&P.
    g. Vibration Eliminator Co., Inc.
    h. Vibration Isolation.
    i. Vibration Management Corp.
    j. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.3 SNUBBERS

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

1. CADDY; brand of nVent Electrical plc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Vibration Management Corp.
5. Vibration Mountings & Controls, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-08 Appendix D for 2009 IBC.
2. Preset Concrete Inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
3. Anchors in Masonry: Design in accordance with TMS 402.
4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
5. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.4 RESTRAINTS - RIGID TYPE

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

1. CADDY; brand of nVent Electrical plc.
2. California Dynamics Corporation.
3. Cooper B-line; brand of Eaton, Electrical Sector.
4. Hilti, Inc.
5. Isolation Technology, Inc.
6. TOLCO.
7. Unistrut; Atkore International.
8. Vibration Mountings & Controls, Inc.

B. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.5 RESTRAINT ACCESSORIES

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

1. CADDY; brand of nVent Electrical plc.
2. Cooper B-line; brand of Eaton, Electrical Sector.
3. Hilti, Inc.
4. Loos & Co.
5. Mason Industries, Inc.
6. TOLCO.
7. Unistrut; Atkore International.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Non-metallic stiffeners are unacceptable.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.6 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolts:

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

    a. Cooper B-line; brand of Eaton, Electrical Sector.
    b. Hilti, Inc.
    c. Mason Industries, Inc.
    d. Powers Fasteners.
    e. Simpson Strong-Tie Co., Inc.
    f. Unistrut; Atkore International.

2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

B. Adhesive Anchor Bolts:

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

    a. Cooper B-line; brand of Eaton, Electrical Sector.

b. Hilti, Inc.
c. Mason Industries, Inc.
d. Powers Fasteners.
e. Simpson Strong-Tie Co., Inc.
f. Unistrut; Atkore International.

2. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.

C. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-05, Ch. 13.

1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

D. Expansion-type anchor bolts are not permitted for equipment in excess of 10 hp that is not vibration isolated.

1. Undercut expansion anchors are permitted.

2.7 CONCRETE INSERTS

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

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Hilti, Inc.
c. Mason Industries, Inc.
d. Powers Fasteners.
e. Simpson Strong-Tie Co., Inc.
f. Unistrut; Atkore International.

B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.

C. Comply with ANSI/MSS SP-58.

2.8 VIBRATION ISOLATION EQUIPMENT BASES

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

1. CADDY; brand of nVent Electrical plc.
2. California Dynamics Corporation.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. Novia; A Division of C&P.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Management Corp.
9. Vibration Mountings & Controls, Inc.

B. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.9 RESTRAINED ISOLATION ROOF-CURB RAILS

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

1. CADDY; brand of nVent Electrical plc.
2. California Dynamics Corporation.
3. Kinetics Noise Control, Inc.
4. Novia; A Division of C&P.
5. Thybar Corporation.
6. Vibration Eliminator Co., Inc.
7. Vibration Management Corp.
8. Vibration Mountings & Controls, Inc.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind forces.

C. Upper Frame: To provide continuous support for equipment and to be captive to resiliently resist wind forces.

D. Lower Support Assembly: To be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. Lower support assembly to have a means for attaching to building structure and a wood nailer for attaching roof materials, and to be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of

assembly. Mount adjustable, restrained-spring isolators on elastomeric vibration isolation pads and provide access ports, for level adjustment, with removable waterproof covers at all isolator locations. Locate isolators so they are accessible for adjustment at any time during the life of the installation without interfering with integrity of roof.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static, wind load within specified loading limits.

3.3 INSTALLATION OF VIBRATION-CONTROL, WIND-LOAD CONTROL, DEVICES.

A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.

B. Provide wind-load control devices for systems and equipment where indicated in Equipment Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

D. Installation of vibration isolators**, wind-load restraints,** must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

F. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install wind-load-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet and longitudinal supports a maximum of 80 feet.
3. Brace a change of direction longer than 12 feet.

H. Install and wind-load restraint cables so they do not bend across edges of adjacent equipment or building structure.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Mechanical Anchor Bolts:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ADJUSTING

A. Adjust isolators after system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:
1. Perform tests and inspections with the assistance of a factory-authorized service representative.
2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
5. Test no fewer than four of each type and size of installed anchors and fasteners selected by Architect.
6. Test to 90 percent of rated proof load of device.
7. Measure isolator restraint clearance.
8. Measure isolator deflection.
9. Verify snubber minimum clearances.
10. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Units will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Warning tape.
4. Pipe labels.
5. Duct labels.
6. Stencils.
7. Valve tags.
8. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: Provide for each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.

d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: aluminum, 0.032-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

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

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Marking Services Inc.
9. National Marker Company.
10. Seton Identification Products; a Brady Corporation company.
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-taping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA70E and other applicable codes and standards.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. National Marker Company.
5. Seton Identification Products; a Brady Corporation company.

B. Material: Vinyl.

C. Minimum Thickness: 0.005 inch.

D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.

E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.

F. Maximum Temperature: 160 deg F.

G. Minimum Width: 2 inches.

2.4 PIPE LABELS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.5 DUCT LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. Kolbi Pipe Marker Co.
8. LEM Products Inc.
9. Marking Services Inc.
10. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings. Also include the following:

1. Duct size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution ducts. Arrows may be either integral with label or may be applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.6 STENCILS

A. Stencils for Piping:

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

    a. Brimar Industries, Inc.
    b. Craftmark Pipe Markers.
    c. Kolbi Pipe Marker Co.
    d. Marking Services Inc.
2. Lettering Size: Size letters in accordance with ASME A13.1 for piping.
3. Stencil Material: Aluminum, brass, or fiberboard.
4. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

B. Stencils for Ducts:

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

    a. Brimar Industries, Inc.
    b. Craftmark Pipe Markers.
    c. Kolbi Pipe Marker Co.
    d. Marking Services Inc.

2. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances of up to 15 ft. and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Aluminum.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: Color as indicated for specific application under Part 3.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

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

    a. Brimar Industries, Inc.
    b. Craftmark Pipe Markers.

c. Kolbi Pipe Marker Co.
d. Marking Services Inc.

2. Lettering Size: Minimum letter height of 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Aluminum.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

2.7 VALVE TAGS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: aluminum, 0.031-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass link chain or beaded chain or S-hook.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Include valve-tag schedule in operation and maintenance data.

2.8 WARNING TAGS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Champion America.
4. Craftmark Pipe Markers.
5. emedco.
6. Kolbi Pipe Marker Co.
7. LEM Products Inc.
8. Marking Services Inc.
9. Seton Identification Products; a Brady Corporation company.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.

B. Sign and Label Colors:

1. White letters on an ANSI Z535.1 safety-blue background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF WARNING TAPE

A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.

B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.

C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

C. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping, ductwork, and equipment.

E. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

F. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

G. Pipe-Label Color Schedule:
   1. Refrigerant Piping: White letters on an ANSI Z535.1 safety-blue background.

3.6 INSTALLATION OF DUCT LABELS

A. Install plastic-laminated, self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.

   1. Provide labels in the following color codes:

      a. For air supply ducts: White letters on blue background.
      b. For air return ducts: White letters on blue background.
      c. For exhaust-, outside-, relief-, return-, and mixed-air ducts: White letters on blue background.

B. Stenciled Duct-Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

   1. For all air ducts: Black letters on white background.

C. Locate label near each point where ducts enter into and exit from concealed spaces and at maximum intervals of 20 ft. where exposed or are concealed by removable ceiling system.

D. Stenciled Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

   1. Black letters on White background.

3.7 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.

   1. Valve-Tag Size and Shape:
      a. Refrigerant: 2 inches, square.

   2. Valve-Tag Colors:

      a. For each piping system, use the same lettering and background coloring system on valve tags as used for the Pipe Label Schedule text and background.

3.8 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Attach warning tags, with proper message, to equipment and other items where scheduled.

END OF SECTION 230553

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:
1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sheet Form Insulation Materials: 12 inches square.
2. Sheet Jacket Materials: 12 inches square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program, certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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

    a. Certainteed; SAINT-GOBAIN.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Manson Insulation Inc.
    e. Owens Corning.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2.4 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Knauf Insulation.
    d. Vimasco Corporation.

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database
5. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Interior Use: Suitable for indoor use on below ambient services.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: 0 to 180 deg F.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and are compatible with insulation materials, jackets, and substrates.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Vimasco Corporation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Vimasco Corporation.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and pre-sized a minimum of 8 oz./sq. yd.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Alpha Associates, Inc.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

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

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

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

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.11 SECUREMENTS

A. Bands:

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

   a. Johns Manville; a Berkshire Hathaway company.
   b. RPR Products, Inc.
2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inchwide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

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

      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.
      4) Nelson Stud Welding.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

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

      1) AGM Industries, Inc.
      2) CL WARD & Family Inc.

3) Gemco.
4) Midwest Fasteners, Inc.
5) Nelson Stud Welding.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

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

      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

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

      1) Gemco.
      2) Midwest Fasteners, Inc.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

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

1) AGM Industries, Inc.
2) Gemco.
3) Midwest Fasteners, Inc.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

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

1) AGM Industries, Inc.
2) Gemco.
3) Midwest Fasteners, Inc.
4) Nelson Stud Welding.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

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

1) Gemco.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

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

a. C & F Wire.
b. Johns Manville; a Berkshire Hathaway company.
c. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents, unless otherwise approved by the engineer-of-record.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping."

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC AND POLYOLEFIN INSULATION

A. Comply with manufacturer's written installation instructions and ASTM C1710.

B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Square and Rectangular Ducts and Plenums:

1. Provide 1/4 inch more per side for a tight, compression fit.
2. Cut sheet insulation with the following dimensions:

a. Width of duct plus 1/4 inch, one piece.
b. Height of duct plus 1/4 inch, plus thickness of insulation, two pieces.
c. Width of duct plus 1/4 inch, plus 2 times the thickness of insulation, one piece.

3. Insulate the bottom of the duct with the sheet from (a) above, then the sides with the two sheets from (b) above, and finally the top of the duct with the sheet from (c) above.
4. Insulation without self-adhering backing:

    a. Apply 100 percent coverage of manufacturer adhesive on the metal surface, then the insulation, except for the last 1/4 inch where sheets will butt together.
    b. Roll sheet down into position.
    c. Press two sheets together under compression and apply adhesive at the butt joint to seal the two sheets together.

5. Insulation with self-adhering backing:

    a. Peel back release paper in 6- to 8-inch increments and line up sheet.
    b. Press firmly to activate adhesive.
    c. Align material and continue to line up correctly, pressing firmly while slowly removing release paper.
    d. Allow 1/4-inch overlap for compression at butt joints.
    e. Apply adhesive at the butt joint to seal the two sheets together.

6. Insulate duct brackets following manufacturer's written installation instructions.

D. Circular Ducts:

1. Determine the circumference of the duct, using a strip of insulation the same thickness as to be used.
2. Cut the sheet to the required size.
3. Apply 100 percent coverage of manufacturer adhesive on the metal surface then the insulation.
4. Apply manufacturer adhesive to the cut surfaces along 100 percent of the longitudinal seam. Press together the seam at the ends and then the middle. Close the entire seam starting from the middle.

3.6 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 5**0** percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not over compress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for **50** percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not over compress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

   1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Comply with manufacturer's written installation instructions.

B. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

C. Insulate duct access panels and doors to achieve same fire rating as duct.

D. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to **one** location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation is the following:
1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation is the following:
1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, exhaust-air duct insulation is the following:
1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

D. Concealed, rectangular, supply-air duct insulation is the following:
1. Glass-Fiber Blanket: 2 inches thick and 1. lb/cu. ft. nominal density.

E. Concealed, rectangular, return-air duct insulation is the following:
   1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

F. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior is the following:
   1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

G. Concealed, supply-air plenum insulation is the following:
   1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

H. Concealed, return-air plenum insulation is the following:
   1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

I. Exposed, round and flat-oval, supply-air duct insulation is the following:
   1. Glass-Fiber Blanket: 2 inches thick and 1 lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:

1. Section 230713 "Duct Insulation" for duct insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program, certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size, as well as ASTM standard designation, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authority having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and Aboveground Piping Insulation Schedule," articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

1. Prefabricated Fitting Covers: Comply with ASTM C450 and ASTM C585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Johns Manville; a Berkshire Hathaway company.

F. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I, for tubular materials, Type II for sheet materials.

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

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2.3 INSULATING CEMENTS

A. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

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

    a. Aeroflex USA.
    b. Armacell LLC.
    c. K-Flex USA.

2. Not all manufacturers comply with sustainability requirements. If sustainability is Project goal, consult manufacturers.
3. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
4. Wet Flash Point: Below 0 deg F.
5. Service Temperature Range: 40 to 200 deg F.
6. Color: Black.

2.5 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Mon-Eco Industries, Inc.
    d. Owens Corning.

2. Permanently flexible, elastomeric sealant.

    a. Service Temperature Range: Minus 150 to plus 250 deg F.
    b. Color: White or gray.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. ASJ+: Aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136, Types I, II, III, IV, and VII.
5. PSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

2.7 TAPES

A. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Johns Manville; a Berkshire Hathaway company.

2. Width: 3 inches.
3. Film Thickness: 2 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 120 percent.
6. Tensile Strength: 20 psi in width.

B. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Johns Manville; a Berkshire Hathaway company.

2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 psi in width.

2.8 SECUREMENTS

A. Bands:

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

    a. Johns Manville; a Berkshire Hathaway company.
    b. RPR Products, Inc.

2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.

3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

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

a. C & F Wire.
b. Johns Manville; a Berkshire Hathaway company.
c. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents, unless otherwise approved by the engineer of record.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap pre-sized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install pre-sized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.9 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, locations of welded fittings for each pipe service defined in the "Piping Insulation Schedule, General" Article.

E. All insulation applications will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

   1. All Pipe Sizes: Insulation is one of the following:
      a. Flexible Elastomeric: 1 inch thick.

2. NPS 3 and Smaller: Insulation is the following:
   a. Flexible Elastomeric: 1 inch thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is one of the following:
   a. Flexible Elastomeric: 1 inch thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is one of the following:

   a. Flexible Elastomeric: 2 inches thick.

D. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is one of the following:
   a. Flexible Elastomeric: 1 inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is one of the following:
   a. Flexible Elastomeric: **2 inches** thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is the following:

   a. Flexible Elastomeric: 2 inches thick.

C. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is one of the following:

   a. Flexible Elastomeric: 2 inches thick.

END OF SECTION 230719

SECTION 232113 – REFRIGERANT, CONDENSATE PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF DIVISION 23 WORK:

A. This work shall consist of furnishing all labor, material, equipment and services necessary for the installation of all equipment specified hereinafter.

B. Systems, piping and components principally relevant to this section include:

1. Refrigerant piping.
2. Condensate drain piping and fittings.
3. Other items where shown on the drawings or as specified.

1.2 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 230100.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING AND FITTINGS:

A. Piping: Copper tubing ASTM B280, Type ACR hard drawn.

B. Fitting: ANSI/ASTM B16.22 wrought copper.

C. Joint: ANSI/ASTM B32, solder grade 95 TA.

D. Provide liquid filter drier, sight glasses, service valves, solenoid valves, and other specialties as required for proper operation of the complete system.

E. Sight glasses shall have metal screw-on protective cap.

F. Install refrigeration specialties in accordance with manufacturer's instructions. Route piping in orderly manner parallel to building structure and maintain gradient. Install piping to conserve building space. Do not interfere with the service requirements of equipment. Group piping wherever practical at common elevations and locations. Slope piping one percent in the direction of oil return.

G. Provide non-conducting dielectric connections when joining dissimilar metals. Install piping to allow for expansion and contraction without stressing piping, joints, or connected equipment.

H. Provide clearances for installation of insulation and access to valves and fittings.

I. Provide insulation on all piping. Provide aluminum jacket on all outdoor piping.

J. Fully charge complete system with refrigerant after testing.

K. Test refrigeration system in accordance with ANSI/ASTM B31.5.

L. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27” vacuum and 200 psig using electronic leak detector. Test to no leakage.

2.2 CONDENSATE DRAIN PIPING AND FITTINGS:

A. Pipe material for above ground installation shall be type "L" hard drawn copper tubing with 125 psi solder joint wrought copper fittings.

B. Fittings for copper pipe shall be wrought copper or cast brass.

PART 3 - EXECUTION

3.1 GENERAL

A. For purposes of clearances and legibility, the contract documents are essentially diagrammatic and, although size and location of piping are drawn to scale wherever possible, contractor shall make use of all data in all of the contract documents and shall verify this information at building site.

B. The contract documents indicate required size and points of termination of pipes and suggest proper routes of piping to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that the contract documents indicate all necessary offsets, and it shall be the work of this section to install piping in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner. The contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. Although the locations of the equipment and piping may be shown on the contract documents in certain positions, the contractor shall be guided by the architectural details and conditions existing at the job, correlating this work with that of others. Provide all offsets as required to produce a neat, workmanlike arrangement.

C. The contractor shall study all drawings and specifications to determine any conflict with ordinances and statutes. Any errors or omissions shall be reported, and any changes shall be shown in drawings made by this section, and any additional work performed at no additional cost to the Owner.

D. Submittal of bid shall indicate the contractor has examined the site and contract documents and has included all required allowances in his bid. No allowance shall be made for any error resulting from contractor's failure to visit job sites and to review contract documents and bid shall include costs for all required drawings and changes as outlined above, all at no additional cost to the Owner.

E. All piping shall be installed to prevent unusual noise from the flow of water under normal conditions. Insert one (1) inch strip of hair felt to isolate all piping from any direct contact with any part of the building, framing, conduit, etc.

F. Springing, bending or forcing of pipe shall not be allowed. Use fittings for all offsets or changes in alignment of piping. Center hubs so cast iron or clay pipe shall lay straight without pinched joints.

G. All changes in directions shall be made with approved fittings. Mitering, saddling or welding of smaller pipe and larger piping is prohibited.

H. Pipe openings shall be closed with caps or plugs during installation. Rags and tin cans are not considered suitable closures. Pipe openings in terrazzo floors shall have semi-permanent closures during construction.

I. Damage by leaks - These contractor's shall be responsible for damage to the grounds, walks, road, buildings, pipe systems, electrical systems and their equipment and contents, caused by leaks in the piping system being installed or having been installed herein. He shall repair at his expense all damage so caused. All repair work shall be performed as directed by the Architect.

J. The use of chemicals or so-called "Stop-Leak" compounds shall not be permitted at any time.

K. Unions shall be provided at connection to all equipment.

L. Escutcheon plates shall be provided at all penetrations of walls, ceilings, floors, etc.

3.2 PIPE JOINING METHODS:

A. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:
1. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.

10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Retain "Airstream Surfaces," "ASHRAE Compliance," or "ASHRAE/IES Compliance" Paragraph below to comply with sustainable design schemes that require compliance with ASHRAE 62.1 and ASHRAE/IES 90.1.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

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

a. Elgen Manufacturing.
b. GSI; a DMI Company.
c. Linx Industries (formerly Lindab).
d. McGill AirFlow LLC.
e. MKT Metal Manufacturing.
f. Nordfab Ducting.
g. SEMCO, LLC; part of FlaktGroup.
h. Set Duct Manufacturing.
i. Sheet Metal Connectors, Inc.
j. Spiral Manufacturing Co., Inc.
k. Stamped Fittings Inc.

B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

C. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

D. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

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

a. Certainteed; SAINT-GOBAIN.

b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.
e. Sekisui Voltek, LLC.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
5. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
6. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

B. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.

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

a. Acoustical Surfaces, Inc.
b. Ductmate Industries, Inc.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.

8. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.

3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK - GENERAL:

A. Assemble and install ductwork in accordance with recognized industry practices which will achieve airtight (5% leakage) and noiseless (no objectionable noise) systems, capable for performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which shall hold ducts true-to-shape and to prevent buckling.

B. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct unusable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearances to 1/2" where furring is shown for enclosure of concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work. Do not locate ductwork over (parallel to) position indicated to extend to deck.

C. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.

D. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2".

E. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

F. Support ductwork in manner complying with SMACNA "Low Pressure Duct Standards - 5th Edition" hangers and supports section.

3.2 DUCT HANGERS AND SUPPORTS:

A. Hangers and supports shall conform to the latest edition of SMACNA Standards Plates 16, 17, 18 and 19.

B. Hangers and supports for ductwork shall not support any other devices unless approved in writing by Engineer.

C. Hanger sizes for rectangular duct shall be as follows for 6 foot spacing.

	Longest Dimension of Duct	Round Hangers	Strap Hangers	Trapeze Shelf Angles
1.	Up thru 18"	1/4" Rod	1"x16 Ga	1"x1"x1/8"
2.	19" thru 30"	3/8" Rod	1"x16 Ga	1"x1"x1/8"
3.	31" thru 42"		1"x16 Ga	1 1/2"x1 1/2" x1/8"
4.	43" thru 60"		1"x16 Ga	1 1/2"x1 1/2" x1/8"

D. All ductwork shall be properly secured directly to the structure of the building using suitable strap or angle hangers. Hangers with a load of 50 pounds or less may be at the bottom chord panel points of bar joists. Hangers with larger loads must be hung from top chord of bar joists. C clamps are not to be used.

E. Risers within duct shaft shall be supported every 8 feet by angle clips.

3.3 DUCT CONSTRUCTION FOR LOW VELOCITY DUCTS:

A. All joints in supply duct work shall be sealed with an approved type duct sealing tape or sealing compound. Where pressure sensitive tape is used for sealing duct joints use an approved type tape sealer in addition to the adhesive on the tape. Joint sealer to be U.L. labeled and fire safe.

B. Changes in shape and dimension shall conform to the following:
   1. For increases in cross-sectional area, the shape of the transformation shall not exceed 1" in 7".
   2. For reductions in area, the slope may be 1" in 4", but 1" in 7" is preferred.
   3. All changes in direction shall either be with a radius not less than 1/2 width of the duct, or square elbow (both) with turning vanes.

3.4 DUCT CONSTRUCTION FOR LOW VELOCITY ROUND DUCTWORK:

A. Approved sealer Minnesota Mining EC-800 shall be applied to the male end of the couplings and fittings. After the joint is slipped together, sheet metal screws shall be placed 1/2" from the joint bead for mechanical strength. Sealer shall be applied to the outside of the joint extending one inch on each side of the joint bead and covering the screw heads. An approved tape shall be immediately applied over the wet sealer.

B. The duct sealer shall be specifically formulated for the job of sealing the field joints for high pressure system. The sealer shall be compatible with an approved type duct tape so the two shall cure and bond together.

C. Flanged joints shall be sealed by Neoprene Rubber gaskets.

D. All duct sealer shall be fire safe and shall be "U.L." approved for this use.

3.5 FLEXIBLE DUCTWORK:

A. The installation shall conform to the techniques shown in the UL approved and factory supplied instructions specified for the product. Submittals shall include product data sheets as well as approved installation instructions. Care is to be taken that all run-outs of flexible duct are installed as straight as practical and fastened so as to eliminate leakage and vibration.

B. Peel back jacket and insulation at end of flexible duct. Fit duct over collar or sleeve and clamps and seal as described for uninsulated flexible duct. Pull jacket and insulation back in place and secure with two wraps of duct tape.

C. Secure flexible duct to collar or sleeve with 1/2 inch wide aluminum galvanized steel or stainless steel bands or clamps and matching seals. Clamping device shall be two inches back from end of flexible duct. Seal with two wraps of duct tape Polyhen #222, Arno #C-520 or Nashua No. 357.

3.6 DUCT LINER:

A. Sound absorbing lining shall be secured to the ducts by a complete covering coat of adhesive and mechanical fasteners 12 inch on centers.

B. For horizontal runs when the duct width or height exceeds 20", the liner shall be additionally secured with fasteners starting within 3" of the upstream transverse edges of the duct liner boards and be spaced at a maximum of 15" O.C. and 15" from the longitudinal joints. On vertical runs, the fasteners shall be used when either dimension exceeds 12".

C. All butt edges of the lining shall be sealed with a suitable mastic. Provide sheet metal nosings at changes from lined to unlined duct. Coated side shall be toward air stream. That portion of ducts that are lined shall be increased in size equal to the thickness of the lining. Duct sizes shown on the plans are net inside dimensions with lining in place.

D. Sound lining shall be applied in the interior of ducts as shown on the Drawings. Sound lining is not to take the place of insulation.

E. Duct liner shall be provided in all concealed horizontal ductwork downstream for a minimum distance of 20 feet of low velocity air handling units, fan terminal boxes, fan coil units, variable volume boxes and 20 feet for distribution devices.

F. All abutting edges of duct linings shall be caulked and all exposed edges of linings shall be installed with a sheet metal nosing.

3.7 CLEANING AND PROTECTION:

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work consists of furnishing all labor, materials, equipment, and services necessary for the installation of all supply, return, ventilation, and exhaust ductwork accessories and related equipment and accessories as indicated on the drawings, required, and as specified.

1.2 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 230100.

PART 2 - PRODUCTS

2.1 LOUVERS (Other than Acoustic Quiet-Vent Louvers)

A. All louvers shall be provided by the general contractor. This contractor shall make all connections thereto and install 18 gauge dual wall insulated blank-off sheets as required and/or indicated on the drawings.

2.2 INSTRUMENT TEST HOLES:

A. Provide test holes Ventlok 699-2 or approved equal complete with gasket and heavy screw cap.

2.3 DUCT ACCESS PANELS:

A. Provide hinged access doors with see-thru break resistant panels, Ruskin ADHW24 or approved equal. Note: The mechanical contractor shall add a 1/8” thick additional sponge rubber gasket to the access doors located on high pressure ductwork. Access doors must be 16” x 16”, unless specified otherwise on drawings.

B. Door frame shall be pre-insulated internally with 1" thick 1-1/2# coated fiberglass in a 24 gauge galvanized steel casing and a 24 gauge galvanized door frame.

C. Frame shall be provided with a foam gasket seal between frame and duct and between frame and door.

D. Hinged door shall be locked with a cam lock latch.

E. For medium pressure applications, access panels shall be hinged to implode.

2.4 MANUAL DAMPERS:

A. Volume dampers shall be manually operated, single or multi-blade type with sleeve bearings, galvanized steel interlocking blades and a galvanized steel frame. In ducts over 12 inches deep use multiple opposed blade type, gang operated dampers with a maximum blade width of 8 inches. Fabricate damper blades of 10 gauge steel with hemmed edges, and a maximum length of 48 inches. Damper operating rod shall be full blade length extended through the duct to externally mounted bearing plates. All insulated ductwork bearing plates shall be flush with insulation finish and fastened to the duct; operating lever shall be of the indicating type with locking quadrant.

B. Furnish and install, where indicated on the drawings or where required, air splitter dampers and/or butterfly dampers with indicating and locking quadrants or push rods and pillow blocks. The dampers shall be two gauges heavier than the ducts in which they are installed. Damper blades shall be riveted to the supporting rod. Splitter dampers shall be sufficiently long to extend the full width of the branch duct to which attached. Where necessary they shall be curved to scoop branch duct air out of the main duct air stream.

C. Splitter dampers shall also be designed to conform to Figure A of Plate No. 28 of the SMACNA Low Velocity Duct Construction Standards.

D. Dampers up to 48" x 12" shall be single blade designed to conform to Figures B, C and D, Plate No. 28 of the SMACNA Low Velocity Duct Construction Standards.

E. Dampers with blade lengths over 48" shall be made in multiple sections with mullions between the sections of blades.

F. Dampers in duct over 12" height shall be multi-bladed and designed to conform to Figures B and C of Plate No. 29 of the SMACNA Low Velocity Duct Construction standards.

2.5 TURNING VANES:

A. All square elbows shall be provided with turning vanes 4" on center, for noise and directional control as manufactured by "Airsan" with mylar separation between air and filter or approved equal.

B. Vanes shall be installed in accordance with Plate No. 22 of the SMACNA Low Velocity Duct Construction standards.

C. Vane runners shall be screwed to the vanes; runner assembly shall be spot welded, riveted or screwed to duct sides.

2.6 GRAVITY BACKDRAFT DAMPERS:

A. Provide gravity backdraft dampers as indicated on drawings complete with frame. Frame shall be of galvanized steel channel construction with corner braces. Damper shall consist of 14 gauge aluminum blades with polyurethane foam edges. Axles shall be of zinc plated steel construction operating in ball bearings.

B. Blades shall be counterbalanced and field adjustable for a range of .01 to .25 inches static pressure.

C. Assembly shall be Ruskin Type CBD-4 or approved equal.

PART 3 - EXECUTION

3.1 LOUVERS

A. All louvers shall be provided by the mechanical contractor. This Contractor shall make all connection thereto and install 18 gauge blank-off sheets as required.

3.2 INSTRUMENT TEST HOLES:

A. Test holes shall be provided at the following locations:
   1. Each discharge duct from air handling units.
   2. Each return duct to air handling units.
   3. Each fresh air duct to air handling units.
   4. Each discharge duct from the duct heating coils.
   5. Each discharge duct from air terminal device.

3.3 DUCT ACCESS DOORS:

A. Access panels shall be located at the following installation:
   1. All automatic dampers in ductwork

3.4 MANUAL DAMPERS:

A. Dampers in exposed ductwork or ductwork accessible from lay-in tile ceilings shall be controlled with quadrants mount on duct walls.

B. Dampers in concealed ductwork or ductwork not accessible due to plaster ceilings, concealed spline ceilings, etc., shall be provided with an extension and quadrant handle in ceiling enclosed in a box with an enameled cover plate.

C. Volume dampers shall be located where shown on drawings and as required by the balancing contractor.

3.5 TURNING VANES:

A. Vanes shall be installed in accordance with Plate No. 22 of the SMACNA Low Velocity Duct Construction standards and be 4" on center minimum.

B. Vane runners shall be screwed to the vanes, runner assembly shall be spot welded, riveted or screwed to duct sides.

END OF SECTION 233300

SECTION 233416 - CENTRIFUGAL HVAC FANS

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 mounted centrifugal fans.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
   2. Rated capacities, operating characteristics, and furnished specialties and accessories.
   3. Certified fan performance curves with system operating conditions indicated.
   4. Certified fan sound-power ratings.
   5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   6. Material thickness and finishes, including color charts.
   7. Dampers, including housings, linkages, and operators.
   8. Fan speed controllers.

B. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
   5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittal: For vibration isolation, supports, indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for selecting vibration isolators, supports, and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fan room layout and relationships between components and adjacent structural and mechanical elements, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Unusual Service Conditions

1. Base fan-performance ratings on the following:

a. Ambient Temperature: 95 deg F dry bulb.
b. Altitude: 600 above sea level.
c. Humidity: 68 deg F wet bulb.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

D. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Startup."

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation, supports, including comprehensive engineering analysis by a qualified professional engineer, using performance and design criteria indicated.

2.2 ROOF MOUNTED EXHAUST FAN

A. General Description:
1. Downblast fan shall be for roof mounted applications
2. Maximum continuous operating temperature is 180 Fahrenheit (82.2 Celsius)
3. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B. Wheel:
1. Constructed of aluminum
2. Non-overloading, backward inclined centrifugal
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

C. Motors:
1. Electronically Commutated Motor
   a. Motor enclosures: Open type
   b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
   c. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
   d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
   e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
   f. Motor shall be a minimum of 85% efficient at all speeds.

D. Housing:
1. Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum
2. Shroud shall have an integral rolled bead for extra strength
3. Shroud shall be drawn from a disc and direct air downward
4. Lower windband shall have a formed edge for added strength
5. Motor cover shall be drawn from a disc
6. All housing components shall have final thicknesses equal to or greater then preformed thickness.
7. Curb cap shall have pre-punched mounting holes to ensure correct attachment
8. Rigid internal support structure

9. Leak proof

E. Housing Supports and Drive Frame:
   1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators

F. Vibration Isolation:
   1. Rubber isolators
   2. Sized to match the weight of each fan

G. Disconnect Switches:
   1. NEMA rated: 4X
   2. Positive electrical shut-off
   3. Wired from fan motor to junction box installed within motor compartment

H. Options/Accessories:
   1. Birdscreen:
      a. Material Type: Stainless
      b. Protects fan discharge
   2. Roof Curbs:
      a. Mounted onto roof with fan
      b. Material: Aluminum
      c. Insulation thickness: 1.5 inches
      d. Coating Type: Permatector
   3. Curb Extension:
      a. Material Type: Aluminum
      b. Coating: Permatector
   4. Curb Seal:
      a. Rubber seal between the fan and the roof curb
   5. Dampers:
      a. Type: Gravity
      b. Prevents outside air from entering back into the building when fan is off
      c. Balanced for minimal resistance to flow
      d. Galvanized frames with prepunched mounting holes
   6. Finishes:
      a. Types: Permatector
   7. Hinge Kit:
      a. Aluminum hinges
      b. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning
   8. Hinge Base:
      a. Aluminum hinges
      b. Hinges and restraint cables are mounted to a base (sleeve)
      c. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning
   9. Tie-Down Points:
      a. Four heavy gauge aluminum brackets to secure the fan in heavy wind applications

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

2.4 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.

C. Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
   1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
   2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.

6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Fans and components will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

END OF SECTION 233416

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

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. Rectangular and square ceiling diffusers.
2. Perforated face registers and grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

1.4 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. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

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

   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes.
   d. Hart & Cooley Inc.
   e. Krueger.
   f. METALAIRE, Inc.
   g. Nailor Industries Inc.
   h. Price Industries.
   i. Titus.
   j. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, white.
5. Face Size: 24 by 24 inches.
6. Face Style: Four cone.
7. Mounting: Surface.
8. Pattern: Fixed.
9. Accessories:

   a. Equalizing grid.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturer subject to compliance with requirements, provide products by one of the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. Dayus Register & Grille Inc.
e. Hart & Cooley Inc.
f. Krueger.
g. METALAIRE, Inc.
h. Nailor Industries Inc.
i. Price Industries.
j. Titus.
k. Tuttle & Bailey.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Perforated.
5. Core Construction: Integral.
6. Mounting: Lay in.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237070 – PACKAGED ROOFTOP HEATING & COOLING UNITS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide rooftop units and all necessary services, accessories, etc. as shown on the Drawings, as scheduled and as specified below.

1.2 SHOP DRAWINGS:

A. Shop drawings shall conform to Section 230100 as well as the following.
   1. Rooftop unit manufacturer shall submit and be responsible for all components, all wiring and controls of rooftop units.
   2. Drawings shall include overall dimensions, clearances and service requirements.
   3. Structural steel drawings with coordinated framing plan shall be submitted with rooftop unit shop drawing and shall have “approved” stamps from both the mechanical subcontractor and the general contractor.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Units shall be specifically designed for outdoor rooftop installation on a roof curb and be completely factory assembled and tested, piped, internally wired, fully charged with R-22, compressor oil and shipped in one piece. Units shall be available for direct expansion cooling, filters, 100% outside air system, 100% exhaust air system, non-fused disconnect switches and all operating and safety controls shall be furnished factory installed. All units shall be UL approved and factory run tested. Cooling capacity shall be rated in accordance with ARI Standard 360. All units shall have decals and tags to aid in service and indicate caution areas. Electrical diagrams shall be printed on long-life water-resistant material and shall ship attached to control panel doors.

B. Units shall be Trane Voyager or equal.

2.2 CASING:

A. Exterior panel shall have a minimum of 1.25-ounce zinc coating per square foot of steel, phosphatized and painted with a slate grey finish which meets a 672-hour salt spray test based on the ASTM B117 standard for all salt spray resistance. Screws shall be coated with zinc-plus-zinc chromate. Eighteen-gauge steel hinged access panels with tiebacks to secure door in open position shall provide access to filters and heating sections. Refrigeration components, supply air fan and compressor shall be accessible through removable panels as standard. Unit control panel shall be accessible through hinged access panel with quick release latches. Double wall construction hinged access doors shall provide access to filters, return/exhaust air, heating and supply fan section. All access doors and panels shall have neoprene gaskets. Interior surfaces or exterior casing members shall have 1/2" Tuf-Skin fiberglass insulation. Unit base shall be watertight with 14 gauge formed load bearing members, formed recess and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tiedown points.

2.3 GAS HEATING: (Modulating burner – Not Staged)

A. The heating section shall have a drum and tube heat exchanger design using corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. In order to provide reliable operation, a negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 45 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat. Units shall be suitable for use with natural gas or propane (field installed kit) and also comply with California requirements for low NOx emissions.

2.4 REFRIGERATION SYSTEM:

A. Compressors:

1. Trane 3-D® Scroll compressors with only three major moving parts with scroll type compression with low vibration. A 3-D compliance provides a completely enclosed compression chamber for increased efficiency. Exhaustive testing on the 3D Scroll, including start up with the shell full of liquid, has proven that slugging does not fail involutes. Direct-drive 3600 rpm, suction gas-cooled hermetic motor. Scroll compressor complete with centrifugal oil pump, oil level sight glass and oil charging valve.
2. Control of compressor shall allow lead/lag of multiple compressors/circuits for even run time to increase life of compressors.

B. Evaporator Coil:

1. Internally enhanced seamless copper tubing of ½" O.D. shall be mechanically bonded to heavy-duty aluminum fins of configured design. Minimum row depth shall be (4) rows.
2. All coils shall be equipped with thermal expansion valves and factory pressure and leak tested at 300 psi.

C. Condenser Coil:

1. Configured aluminum fin or configured copper fin secondary surface shall be mechanically bonded to primary surface of 3/8" O.D. seamless copper tubing. Subcooling circuit shall be provided as standard. All coils shall be factory tested at 450 psig air pressure and vacuum dehydrated. All vertically mounted coils shall be provided with inlet hail screen guards.

D. Condenser Fans and Motors:

1. All condenser fans shall be vertical discharge, direct drive fans, statically balanced, with steel blades and zinc plated steel hubs. Condenser fan motors shall be three-phase motors with permanently lubricated ball bearings, built-in current and thermal overload protection and weather tight slingers over the motor bearings.

2.5 AIR HANDLING SYSTEM:

A. Supply Fan:

1. All supply fans shall have two double inlet, forward-curved fans mounted on a common shaft with fixed sheave drive and shall be dynamically balanced and tested in factory. Supply fan shall be test run in unit as part of unit test and unit shall reach rated rpm before the fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000 hours average life. Extended grease lines shall allow greasing of bearings from unit filter section. Fan motor and fan assembly shall

be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assembly shall be completely isolated from unit and fan board by 2" deflection spring isolation on motor. All supply fan motors meet the latest U.S. Energy Policy Act.

B. Controls:
   1. Unit shall be complete factory wired with necessary control and contactor pressure lugs or terminal block for power wiring. Units shall provide an internal location for a non-fused disconnect with external handle for safety. Unit mounted microprocessor controls shall provide anti-short cycle timing for all compressors. A variable frequency drive assembly shall be provided to vary the fan speed to meet the load conditions.

C. Unit Controller:
   1. DDC microprocessor controls shall be provided to control all unit functions. The control system shall be suitable to control VAV applications. The controls shall be factory installed and mounted in the main control panel. All factory installed controls shall be fully commissioned (run tested) at the factory. The unit shall have a Human Interface Panel with a 16 key keypad, a 2-line X 40 character clear English display as standard to provide the operator with full adjustment and display of control data functions. The unit controls shall be used as a standalone controller, or as part of building management system involving multiple units. Unit shall have a LON interface with Building BAS.
   2. The unit shall be equipped with a complete microprocessor control system. This system shall consist of temperature and pressure (thermistor and transducer) sensors, printed circuit boards (modules), and a unit mounted Human Interface Panel. Modules (boards) shall be individually replaceable for ease of service. All microprocessors, boards and sensors shall be factory mounted, wired and tested.
   3. The microprocessor boards shall be standalone DDC controls not dependent on communications with an on-site PC and Building Management Network. The microprocessors shall be equipped with on-board diagnostics, indicating that all hardware, software and interconnecting wiring are in proper operating condition.
   4. The modules (boards) shall be protected to prevent RFI and voltage transients from affecting the board's circuits. All field wiring shall be terminated at separate, clearly marked terminal strip. Direct field wiring to the I/O boards is not acceptable.
   5. The microprocessor's memory shall be non-volatile EEPROM type requiring no battery or capacitive backup, while maintaining all data.
   6. The Human Interface Panel's keypad display character format shall be 40 characters x 2 lines. The character font shall be 5 x 7 dot matrix plus cursor. The display shall be Supertwist Liquid Crystal Display (LCD) with blue characters on a gray/green background which provides high visibility and ease of interface. The display format shall be in clear English. Two- or three-digit coded displays are not acceptable.
   7. The keypad shall be equipped with 16 individual touch-sensitive membrane key switches. The switches shall be divided into four separate sections and be password protection from change from unauthorized personnel. The six main menus shall be STATUS, SETPOINTS, DIAGNOSTICS, SETUP, CONFIGURATION, and SERVICE MODE.
   8. Short Circuit Current Rating: The unit short-circuit current rating shall meet or exceed the short circuit interrupting rate of the circuit breaker ahead of the branch circuit feeding the unit.

2.6 FILTERS:

A. Filters shall mount integral within unit and be accessible by hinged access panels.

B. Provide a high static pressure filter sensor and alarm.

2.7 High Efficiency Panel Filters:

A. Shall be 2" high efficiency media filters with average dust spot efficiency of 30% and an average arrestance in excess of 90% when tested in accordance with the most recent version of ASHRAE 52.

2.8 EXHAUST AIR:

A. Modulating 100% Exhaust Fan with Statitrac™ Control:

B. Two, double-inlet, forward-curved fans shall be mounted on a common shaft with a fixed sheave drive. All fans shall be dynamically balanced and tested in factory before being installed in unit. Exhaust fan shall be test run as part of unit final run test. Unit shall reach rated rpm before fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated 10/200,000 ball bearings average life. Extended grease lines shall be provided to allow greasing of bearings from the unit filter section. Fan motor and assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assembly shall be completely isolated from unit and fan board by spring isolation on motor. The 100% modulating exhaust discharge VFD shall be modulated in response to building pressure. A differential pressure control system, (Statitrac™) control system shall then modulate the VFD to control the building pressure to within the adjustable, specified dead band that shall be adjustable at the Human Interface Panel. All exhaust fan motors meet the most recent version of the U.S. Energy Policy Act.

2.9 OUTSIDE AIR:

A. 0-100% Modulating Economizer:

B. Operated through the primary temperature controls to automatically utilize OA for “free” cooling. Automatically modulated return and outside air dampers shall maintain proper temperature in the conditioned space. Economizer shall be equipped with an automatic lockout when the outdoor enthalpy temperature is too high for proper cooling. Minimum position control shall be standard and adjustable at the Human Interface Panel or with a remote potentiometer or through the building management system. A spring return motor shall ensure closure of OA dampers during unit shutdown or power interruption.

C. Mechanical cooling shall be available to aid the economizer mode at any ambient. Ultra-low leak economizer dampers shall be standard with a leakage rate of 1.0% of nominal airflow (400 CFM/ton) at 1" w.g. static pressure.

D. Provide a factory mounted airflow measurement station (AMS). The AMS shall measure 40 CFM/ton to maximum airflow.

2.10 ROOF MOUNTING CURB:

A. Refer to drawings.

2.11 ELECTRONIC ZONE SENSORS:

A. See Temperature Controls.

2.12 SYSTEM CONTROL:

A. Return Fan Variable Frequency Drives without bypass. Provided with all the necessary controls to control/maintain building space pressure through a VAV rooftop unit. The variable frequency drive (VFD) modulates the speed of the exhaust fan motor in response to building pressure. A differential pressure control system uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure. The VFD received a 0-10 vdc signal from the unit microprocessor based upon the space static pressure and causes the drive to accelerate or decelerate as required to maintain the space pressure within the deadband.

B. VAV Supply Air Temperature Control with Variable Frequency Drives without Bypass - Provided with all necessary controls to operate a VAV rooftop unit from the discharge air temperature, including discharge air microprocessor controller and discharge air sensor. The microprocessor controller coordinates the economizer control and the stages of cooling with discharge air temperature reset capabilities. Includes factory installed and tested variable frequency drives (VFD) to provide supply fan motor speed modulation. VFD received 0-10 vdc from the unit microprocessor based upon supply static pressure and causes the drive to accelerate or decelerate as required to maintain the supply static pressure set point.

2.13 AMBIENT CONTROL:

A. Controls shall be provided to allowance unit refrigeration system operation down to 50□F ambient outdoor air temperature.

2.14 AGENCY APPROVAL:

A. Rooftops must be provided with UL approval.

2.15 MISCELLANEOUS OPTIONS:

A. Non-fused Disconnect Switch with External Handle - External handle enables the operator to disconnect unit power with the control box door closed for safety.

B. Hot Gas Bypass - Valves, piping and controls are all included to allow operation at low airflow, avoiding coil frosting and damage to compressor.

C. Comparative Enthalpy Control - used with the fresh air economizer two enthalpy sensors are provided to compare total heat content of the indoor air and outdoor air to determine the most efficient air source when economizing.

D. High Duct Temperature Thermostats - Two manual reset thermostats, one located in the discharge section of the unit set at 240 F and the other in the return section set at 135F. The rooftop will shut down if the thermostats are tripped.

E. Building Automation System (through BACNet) - Provided for those cases where the customer uses a non-Tracer building management systems. The BAS module provides a binary input for Demand Limiting, four (4) analog inputs for set point adjustment and five (5) relay outputs for diagnostic reporting. Inputs can use a potentiometer or 0-5 vdc signal.

F. High Efficiency Motors - Supply and exhaust fans are provided with high efficiency motors.

G. Extended Grease Lines - Lines allow greasing of supply and exhaust fan bearings through the filter access door.

H. Access Doors - Hinged access doors provide easy access to supply fan, filters, exhaust fan and the heating section. These access doors feature double wall construction with dual density insulation sandwiched between 18-gauge and 20-gauge galvanized steel panels for strength and durability.

I. Trane Communication Interface Module - Provides interface to Trane's Integrated Comfort System (ICS) which allows control and monitoring of the rooftop by a Tracer building management system.

J. GFI Convenience Outlet (Factory Powered) - A 15V, 115V Ground Fault Interrupter convenience outlet shall be factory installed. It shall be wired and powered from a factory mounted transformer. Unit mounted non-fused disconnect with external handle shall be furnished with factory powered outlet.

K. Two Inch Spring Isolators - Supply and exhaust fan assemblies are isolated with two-inch nominal deflection steel spring isolators.

L. VFD Line Reactors - Provide on all units with VFD.

M. Stainless steel drain pan.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Rooftop units shall be installed in accordance with the shop drawings and the manufacturer's recommendations. The roof curbs shall be continuously supported by shims tack-welded in place to make the curb top flat, square and level.

END OF SECTION 237070

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.
2. Fan Belts: One set(s) for each air-handling unit fan.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Complete Unit: One year from date of Substantial Completion.
b. For Compressor: Five year(s) from date of Substantial Completion.
c. For Parts: One year from date of Substantial Completion.
d. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trane; a business of American Standard companies.
2. Daikin AC
3. Mitsubishi
4. Carrier

5. York/JCI

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
4. Fan: Direct drive, centrifugal.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    f. Mount unit-mounted disconnect switches on interior of unit.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1
        2) Depth: A minimum of 1 inch deep.

    b. Single wall, stainless-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: 3/4”.

    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

8. Air Filtration Section:

    a. General Requirements for Air Filtration Section:

        1) Comply with NFPA 90A.
        2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

    b. Washable Panel Filters:

        1) Factory-fabricated, viscous-coated, flat-panel type.
        2) Thickness: 1 inch.
        3) Arrestance according to ASHRAE 52.1: 20.
        4) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
    1. Thermostat shall be hard wired, installed on the wall. Wireless controllers are not acceptable.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

E. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

F. No condensing units shall be installed indoors.

G. Condensing units shall be connected to concrete pads with the perimeter of the base fenced. Maintain the manufacturer’s minimum clearance requirements as well as the NEC requirements (whichever is more stringent).

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Pressure test shall be verified by the Commissioning Agent.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup check according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 239000 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RECORD DRAWINGS - BUILDING:

A. The mechanical contractor shall keep a record copy of the bid set and fabrication drawings at the job site and shall accurately maintain a record with dimensions and elevations of all changes to the contract drawings as the job progresses. At the completion of the job, the contractor shall make changes which occurred during construction on drawings and submit to the Engineer.

B. Show all equipment numbers.

C. Provide complete equipment and piping schematics showing all devices and all thermometers and gauges with normal operating temperature and pressure.

D. Revise all equipment schedules to show actual equipment furnished.

1.2 DEMONSTRATION OF COMPLETE MECHANICAL SYSTEMS:

A. After installation has been completed, equipment has been tested, systems placed in permanent operation, and all adjustments made, a competent start-up technician shall be provided to instruct the Owner's designated representatives in the operation and maintenance of the equipment. The start-up technician shall be at the site continuously during the instructional period.

B. Operating and Maintenance Manuals:

1. The form in which the operating maintenance manual is to be presented shall be subject to approval by the Engineer. Three copies of the manual shall be provided.
2. The following items, together with any other necessary and pertinent data, shall be included in the manual. This list is not necessarily complete and is only to be used as a guide.

    a. Suggested settings of all control and switches for normal operation with description of control and its location.
    b. A check list for periodic maintenance of all equipment, with maintenance and cleaning instructions.
    c. As built wiring, interlock, and control diagrams for the equipment, with color coding shown on wiring and interlock diagrams.
    d. Parts list for all replaceable service parts and indicate where they may be purchased.
    e. Manufacturer's cuts and rating tables for all equipment, including copies of all shop drawings.

f. Oiling, lubricating, and greasing data, showing how to lubricate, frequency, and which lubricants to use.
g. Complete electrical load data from operation tests.
h. Test data on all equipment.
i. Belt sizes, types, and lengths.
j. Serial numbers of all principal pieces of equipment.
k. Manufacturers', suppliers, and subcontractors' names, addresses, and telephone numbers.

1) The first page shall identify project and give name, address and phone number of Engineer, Mechanical and Electrical contractors and any service companies involved and give name and night phone of each party responsible for service.

l. Copies of the wiring diagrams shall be framed under glass and posted in the Equipment Room.

1.3 LABELS, IDENTIFICATION AND TAGS:

A. All control components for equipment shall be identified using 3/4" high permanent engraved bakelite nameplates - white letter-black background, with minimum 1/4" high letters. Nameplates shall be permanently attached to device or to wall or mounting panel above device.

B. All equipment including but not limited to compressors, pumps, equipment cabinets shall be identified with yellow 1 inch high letters. Permanent engraved bakelite nameplates - yellow letters - gray background with minimum 1/4 inch high letters. Permanently attach nameplate to equipment.

1.4 WARRANTIES:

A. Deliver to Owner all warranties, guarantees, etc. and obtain written receipts.

1.5 PUNCH LIST:

A. During construction period the Engineer will issue punch lists. These items shall be completed before Engineer will approve next application for payment. Final punch list work shall be completed before acceptance and final payment.

1.6 FINAL INSPECTION AND ACCEPTANCE:

A. The engineer or his authorized representative will entertain the request for final inspection and acceptance only after the following items are done.

B. Submit a list of uncompleted items, if any, and advise when the items will be done.

C. Complete all items on Engineer's pre-final punch list.

D. Final inspection and tests of the completed construction shall be performed in the presence of the Engineer or his representative and shall be at such times as are convenient to the Engineer. Final tests shall show conclusively that all equipment performs its intended and specified function and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for the tests shall be furnished by this contractor at his own expense.

1.7 FINAL CLEAN UP:

A. During construction this contractor shall keep the site clear of debris and upon completion of construction he shall clean up the premises and to remove all evidence of his work.

B. The mechanical contractor shall resolve all questionable items to be corrected prior to an inspection by the Engineer.

1.8 GUARANTEE:

A. The guarantee shall be as stated in the General Conditions, and the General Provisions of this section.

END OF SECTION 239000

SECTION 239800 – TESTING AND BALANCING SYSTEMS

PART 1 - GENERAL

1.1 SCOPE:

A. This work includes testing all mechanical equipment including the rooftop units and exhaust fan to determine that its performance is in compliance with the requirements of the contract documents and the adjustment and balancing of the systems so that fluid quantities are delivered to locations as required by the contract documents and that the temperature, and/or volume can be controlled in accordance with the design intent and space requirements. This work shall not imply a guarantee of the total system, nor shall it relieve contractors or manufacturers of their normal responsibilities.

B. A mandatory sum in the amount of $12,000 will be withheld (in addition to normal 5% retainers) until such time as the tab report is found to be acceptable to the engineer.

C. The mechanical contractor shall perform all work described in preparation of equipment and systems for testing and balancing.

D. The actual testing and balancing of the air system shall, including all exhaust fans and RTU units and terminal units, shall be performed by a separate firm specializing in testing and balancing of mechanical equipment. The T&B sub-contractor shall meet the standards but not necessarily be a member of the Associated Air Balance Council or shall be an engineering firm with principals registered in N.C. and specializing in testing and balancing of HVAC systems. The mechanical contractor shall be responsible for test and balance of the system.

E. Testing and balance shall not begin until the system has been completed and is in full working order. The mechanical contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

F. The mechanical contractor shall pay the costs of operating the mechanical equipment during the testing and balancing period. He shall make arrangements with the Owner to pay for his electrical power and water.

1.2 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

B. TAB Specialists Qualifications, Certified by NEBB or TABB:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. Submit qualifications to architect/Engineer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION OF EQUIPMENT FOR TESTING AND BALANCING:

A. The mechanical contractor shall, upon completion of items of work required by his contract and prior to the commencement of the Testing and Balancing Subcontract, as hereinafter specified, thoroughly clean all dirt and debris from equipment. All bearings, gear boxes, wearing surfaces, or other equipment components requiring lubrication shall be properly serviced as recommended by the equipment manufacturer, and shall be tagged with the date of service and type of lubricant used. All specified cleaning and protective devices shall then be installed in equipment, and systems shall be placed in continuous operation. All other mechanical equipment, including temperature and operating control devices shall have been adjusted and calibrated for complete and functional operating service.

B. The mechanical contractor shall provide the Testing and Balancing Sub-contractor at the earliest possible time, copies of all approved equipment, specialties, and control submittal data, together with a set of contract plans and specifications.

C. The mechanical contractor shall provide all thermometer wells, pressure gauge connections, capped duct thermometer openings, etc., as the T&B sub-contractor require. The T&B sub-contractor shall assist the mechanical contractor in locating these devices as the job progresses.

D. The sub-contractor shall provide sufficient time from the complete installation of all systems to the final established completion date of this project so that testing and balancing can be accomplished.

3.2 TESTING PROCEDURES FOR AIR SYSTEMS:

A. Test and adjust blower RPM to design requirements. Record all pulley and belt data.

B. Test and record motor full load and operating amperes and voltage on all three phases.

C. Make pivot tube traverses of main supply ducts and obtain design CFM at fans. Also make velocity traverses of all coils and filter banks.

D. Test and record system static pressures, suction and discharge.

E. Test and adjust system for design recirculated air, CFM.

F. Test and adjust system for design CFM outside air.

G. Test and record entering air temperatures. (D.B. heating and cooling).

H. Test and record entering air temperatures. (W.B. cooling).

I. Test and record leaving air temperatures. (D.B. heating and cooling).

J. Test and record leaving air temperatures. (W.B. cooling)

K. Adjust all main supply, return, and exhaust air ducts to proper design CFM.

L. Adjust all zones to proper design CFM supply, return, and exhaust.

M. Test and adjust operation of frequency drive fans.

N. Test and adjust each diffuser, grille, and register to within 5% of design requirements.

O. Size, type, and manufacture of diffusers, grilles, registers, and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations and checked against field measurements.

P. All fire dampers and combination fire-smoke dampers shall be tested to prove they open and close properly.

Q. All diffusers, grilles, and registers shall be adjusted to minimize drafts and noise in all areas.

R. As a part of the work of this contract, the mechanical contractor shall make any changes in the pulleys, belts, and dampers required for correct balance at no additional cost to owner or engineer.

S. Submit final report to Architect/Engineer.

END OF SECTION 239800

SECTION 239850 – SYSTEM TESTING, CLEANING & STARTUP

PART 1 - GENERAL

1.1 SCOPE:

A. This work includes cleaning the various air and water systems, pressure testing to ensure tightness, and start-up of the various systems to prove their operational capability.

PART 2 - PRODUCTS

2.1 GENERAL

A. This contractor shall provide all materials used for testing.

PART 3 - EXECUTION

3.1 TESTING SYSTEMS:

A. Prior to testing, remove or otherwise protect from damage all control devices, trap bellows, air vents, or other devices not designed to withstand the test pressure.

3.2 TESTS FOR LOW PRESSURE AND MEDIUM PRESSURE DUCT:

A. All low-pressure supply, return and exhaust duct, plenums, casings and medium pressure ductwork shall be tested and made substantially airtight before covering or concealing. Supply duct, plenums, and casings shall be tested under operating pressure. Return and exhaust ducts and casings shall be tested under 1 inch WC positive pressure. Substantially airtight means that no air leakage can be heard or felt at any joint when the system is subjected to the test pressure, and measurement devices result in no more than the allowable 5% as listed above.

B. Tests shall be made before insulation is applied to ductwork or fittings. The A/E representative shall be given the opportunity to observe all tests and items under test shall not be covered up until after the A/E representative has observed the test or has been given a letter waiving the right of observation of the test.

C. Total allowable leakage of the low-pressure system shall not exceed 5% of the air handling capacity of the system, nor 2% of the air handling capacity of the medium pressure system.

3.3 CLEANING OF SYSTEMS:

A. The inside of the roof top units and the exhaust fan, ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, duct, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building and the ducts, plenums; casings, and other items specified hereinbefore have been vacuum cleaned. It shall be the responsibility of this contractor to maintain the system in this clean condition until final acceptance.

3.4 START-UP AND TEST:

A. Each system shall be started up and a preliminary test made as follows:

1. This contractor shall make trial runs of each piece of equipment furnished by him. This contractor shall provide all oil, grease, and other lubricants for the operation of all equipment until acceptance. This contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to date of acceptance of the equipment, and for a period thereafter as per the general building warranty. The contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion.
2. The contractor shall align each shaft and adjust all pulleys to run substantially vibration-free. Where equipment cannot be so adjusted by the contractor, the manufacturer shall provide a machinist or serviceman to make these adjustments. Vibration-free is construed to mean that rotating machinery shall not exceed a self-excited vibration velocity of 0.10 inches per second in any direction when measured with a vibration meter on the bearing caps of the machine.
3. Belts shall be checked for alignment and tightened to proper tension.
4. Overload elements in motor starts shall be checked and proper elements provided as required for the motor full load amp rating.
5. Equipment shall be started per manufacturer's instructions and run in.
6. Read amperage and voltage on each motor the first time it is started, and check direction of rotation.
7. Run an operating test on each piece of equipment. The tests shall be sufficient to show that the equipment has been run and observed and shall include the following:
8. Each fan amp. draw and discharge static pressure.
9. Volts and amps on each motor.
10. Results of preliminary tests shall be submitted before test and balance sub-contractor commences his work.
11. Provide and install a clean set of filters at the time of acceptance plus two spare sets of filters. Filters shall be maintained by the mechanical contractor during the times of dry wall finishing operations with all return inlets separately filtered with media meeting a MERV 8 rating and replaced as required by the general contractor.

END OF SECTION 239850

SECTION 239860 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. The commissioning process requires detailed O&M documentation

1.2 MECHANICAL CONTRACTOR'S RESPONSIBILITY

A. Contractor shall obtain all specified operation and maintenance data. Using this data contractor shall prepare and submit operation and maintenance manuals with the following format:

B. Quantity: Provide one copy of each of O&M manuals to the engineer and to the commissioning agent.

C. Format: 8 1/2" x 11" loose leaf binders. Each binder shall be clearly labeled on the front and spine. Use as many binders as required. Do not overload binders; allow for ten percent free space in ach binder for additional data. There shall be dividers with permanently marked tabs of card stock separating each section and subsection. Tab labels shall not be handwritten.

D. There shall be a title page and table of contents in the front of each binder for each binder's contents. In each binder, there shall be a main tab for each specification section. Behind the section number tab there shall be the equipment ID tag sub-tab for each piece of major equipment (or group, if small or numerous). These sub-tabs shall be similar to the specification number tabs but of a different color. Behind each equipment name tab shall be the following sections, in the given order, divided by a double weight colored sheet labeled with the title of the section.

1. Suppliers and Contractor's List: List of contractors and suppliers who supplied and installed equipment, materials or finishes, organized by Division and system. Include company name, address and telephone number.
2. Equipment Identification: name plate information for each piece of equipment, on forms approved by Commissioning Agent.
3. Installation Instructions: Manufacturer's printed instructions describing manufacturer's recommended installation procedures.
4. Operating Instructions: manufacturer's printed instructions describing proper operation.
5. Maintenance Instructions: Manufacturer's printed instructions describing manufacturer's recommended maintenance.
6. Spare parts list: Parts list and manufacturer's recommended spare parts, edited to omit items which do not apply to this installation.
7. Drawings List: List of applicable contract construction drawings.
8. Shop Drawings: Final reviewed and approved shop drawings.

9. Control Drawings: Include the control drawings for the piece of equipment and its components, including the sequence of operation. This section will be provided by the controls contractor. The drawings will be repeated in the control contractor's O&M submittals.
10. Product Data: manufacturer's product data for equipment, systems, materials and finishes.
11. Certifications: Include the following:

    a. Copies of inspection reports prepared by authorities having jurisdiction
    b. Certified copies of test reports prepared by independent testing agencies.
    c. Any other certificates required by Contract Documents.

12. Warranties and Bonds: Copy of manufacturers' warranties, maintenance bonds and service contracts.
13. Report: Include the following:

    a. Reports documenting the performance of tests required by the Contract Documents and the results of those tests.
    b. Documentation of other material, equipment or system related information required by the Contract Documents.

14. Special Tools: A list of any special tools required to service or maintain the equipment.
15. Specifications: This section is comprised of the component or system specification section copied and inserted complete with all addenda.
16. System Description: This section shall include the individual equipment portion of the overall system Designation Documentation Narrative, if available. It will contain simplified professionally drawn single line system diagrams on 8 1/2" x 11 or 1 x 17 sheets if the system's control drawing is not adequate.
17. Preventive Maintenance Instructions: This section shall include condensed type-written excerpts from the manufacturers' written instructions or weekly, monthly, quarterly, annual, etc maintenance. This summary shall be prepared by the plumbing contractor with help from the equipment supplier. It shall be prepared for all items.
18. Condensed Operating Instructions: This section shall include condensed instructions for start-up, shut-down, emergency operation, safety precautions, unusual features and troubleshooting suggestions. Where control is clearly covered in controls description, it is not to be duplicated here. In addition, a copy of these instructions shall be clearly laminated and secured adjacent to the equipment where it can be easily read by operating personnel. These instructions shall be provided for heat rejection equipment, rooftop units (greater than 10 tons), and control system.

E. Commissioning Record and Testing Data: There will be a separate manual dedicated to documenting the commissioning process which will include all certifications and testing data and some repeating of O&M data. Description of this manual is found in Section 239990 and shall be prepared by the commissioning agent.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.1 SUBMISSION OF DATA

A. Submit a preliminary operation and maintenance data manual to the Commissioning Agent for review and to aid the Commissioning Agent in the preparation of the functional test procedures. Submit data 30 days prior to functional testing of systems.

B. Submit the final operation and maintenance data manual prior to substantial completion inspection.

END OF SECTION 239860

SECTION 239900 – COMMISSIONING OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION:

A. The purpose of this section is to specify the Division 23 Contractor's responsibilities and participation in the commissioning process.

B. Commissioning is primarily the responsibility of the Commissioning Agent, with support for start-up, testing and commissioning the responsibility of the Division 23 Contractor. The commissioning process does not relieve this Contractor from participation in the process or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner. The commissioning procedure shall comply with ASHRAE Standard 0-2005.

C. Work of Division 23 includes:

1. Testing and start-up of the mechanical equipment.
2. Assistance in functional testing to verify testing and balancing, and equipment/ system performance.
3. Providing qualified personnel to assist in commissioning tests, including seasonal testing.
4. Completion and endorsement of pre-functional test checklists provided by the Commissioning Agent to assure that Division 23 equipment and systems are fully operational and ready for functional testing.
5. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
6. Providing operation and maintenance information and as-built drawings to the Commissioning Agent for review verification and organization, prior to distribution.
7. Providing assistance to the Commissioning Agent to develop, edit, and document system operation descriptions.
8. Providing training for the systems specified in this Division with coordination by the Commissioning Agent.

D. Work of Division 23 specific to automation temperature control system includes:

1. Testing and start-up of the equipment including completed control systems, point-to-point verification of all system inputs and outputs, calibration checks, and accurate system graphics.
2. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial commissioning.
3. Providing training to the Commissioning Agent on basic operation and programming of the control system.
4. Fulfilling contract and warranty requirements by providing equipment, software, software programming materials, and labor necessary to correct deficiencies found during the commissioning process.
5. Completion and endorsement of pre-functional test checklists provided by the Commissioning Agent to assure that Division 23 equipment and systems are fully operational and ready for functional testing.
6. Providing operation and maintenance information and as-built drawings to the Commissioning Agent for review verification and organization, prior to distribution.
7. Providing assistance to the Commissioning Agent to develop, edit, and document system operation descriptions. Incorporate correct and final control sequence documentation on control drawings.
8. Providing training for the systems specified in this Division to the Owner, with coordination by the Commissioning Agent.

1.3 RELATED WORK:

A. All testing and start-up procedures and documentation requirements specified within Division 01, Division 23, and related portions of this project.

B. Commissioning procedures that require participation of Division 23 Contractor.

C. Cooperate with the Commissioning Agent in the following manner:

1. Install balancing dampers/balancing cocks, access doors, test ports, and P&T taps as required by the Commissioner and/or the test and balance agency.
2. Allow sufficient time before final completion dates so that test and balance and commissioning testing can be accomplished.
3. Provide labor and material to make corrections when required without undue delay.
4. Put all heating, ventilating, and air conditioning systems and equipment into full operation and continue the operation of the same during each working day of testing and balancing and commissioning.
5. Include the costs of dampers, replacement sheaves and belts as required, to obtain satisfactory system performance, as requested by the test and balance Contractor or the Commissioning Agent.
6. Provide test holes in ducts and plenums where directed or necessary for pitot tubes for taking air measurements and to balance the air systems. Test holes shall be provided with an approved removable plug or seal. At each location where ducts or plenums are insulated, test holes shall be provided with an approved extension with plug fitting.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT:

A. Standard test equipment for commissioning will be provided by the Commissioning Agent.

B. Division 23 shall provide standard and specialized test equipment as necessary to test and start up the mechanical equipment.

C. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Agent in the commissioning process.

2.2 ATC TEST EQUIPMENT:

A. This Contractor shall provide all equipment, software, and all test programming support as necessary to start up, calibrate, debug, and verify proper function of the control/facility management system. This equipment and software shall be provided for use by both the test and balance Contractor and the Commissioner.

B. Proprietary test equipment, including hardware, software, and specialized test instruments, required by the manufacturer for system testing and commissioning, whether specified or not, shall be provided by the control system contractor. This Contractor shall provide the test equipment, demonstrate its use, and assist the Commissioning Agent in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING:

A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.

B. A commissioning plan will be developed by the Commissioning Agent. Upon request of the Commissioning Agent, this Contractor shall provide assistance and consultation. The commissioning plan will be developed prior to completion of the installation. This Contractor is obligated to assist the Commissioning Agent in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If system modifications/ clarifications are incorporated to this and related sections of work, commissioning of this work will be made at no additional cost to the Owner. If Contractor-initiated system changes have been made that alter the commissioning process, the

Commissioning Agent will notify the Architect, and the Contractor may be obligated to compensate the Commissioner to test the revised product, or confirm the suitability/unsuitability of the substitution or revision.

C. Specific pre-commissioning responsibilities of Division 23 are as follows:

1. Normal start-up services required to bring each system into a fully operational state. This includes motor rotational check, cleaning, filling, purging, control sequences of operation, leak testing, full-load and part-load performance, etc. The Commissioning Agent will not begin the commissioning process until each system is complete, including normal contractor start-up.

D. The Contractor shall perform pre-functional testing and start-up on the following equipment and systems under the observation of a third party. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Agent.

1. Heat Pump and Condenser Units
2. Diffusers and Grilles
3. Insulation
4. Temperature Controls
5. Exhaust and Outdoor Air Supply Fans

E. Specific pre-commissioning responsibilities of Division 23 pertaining to automatic temperature control systems are as follows:

1. Factory-training technician for start-up, checkout, and calibration services for the following items of equipment shall be required for the project:

a. Building Automation System

2. Normal start-up services required to bring each system into a fully operational sate. This includes electrical continuity checking, elimination of ground faults, pneumatic leak checking, sensor calibration, control sequences of operation, interlocks, etc. This also includes all software and hardware to render fully operational control systems. The Commissioning Agent will not begin the commissioning process until each system is complete, and functionally verified by this Contractor.
3. The Contractor shall independently complete all the pre-functional test of the control system. Pre-functional test forms will be provided by the Commissioning Agent to be completed by the Contractor.

F. Factory start-up services will be provided for key equipment and systems specified in Division 23. This Contractor shall continue this work with the manufacturer and the Commissioner.

G. Commissioning is intended to being upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is in the best interests of the Owner. Commissioning activities and schedule will be coordinated with the Contractor. Start of commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING:

A. Provide skilled technicians to start-up and debug all systems within the division of work. These same technicians shall be made available to assist the Commissioning Agent in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Agent and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. System problems and discrepancies may require additional technician time, Commissioning Agent time, redesign and/or reconstruction of systems, and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Agent reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Agent to get the job done. A liaison or intermediary between the Commissioning Agent and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

3.3 WORK TO RESOLVE DEFICIENCIES:

A. In some systems mis-adjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and Commissioning Agent. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit the timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Architect/Engineer indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities. If the deadline(s) passes without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.4 ADDITIONAL COMMISSIONING:

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers, and Commissioning Agent shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

3.5 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS:

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.

C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. Each Contractor and supplier will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.6 RECOMMISSIONING:

A. After the initial and peak seasoning commissioning is completed, there may be additional work required to serve new or revised loads. This work is not part of the contract.

3.7 TRAINING:

A. This Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.

B. Training will be conducted jointly with the Commissioning Agent, the design engineers, the equipment vendors, and the Contractor. The Contractor will be responsible for the generic training, as well as instructing the Owner's staff on the system peculiarities specific to this project.

3.8 SYSTEMS DOCUMENTATION:

A. In addition to the requirements of Division 01, update Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations. All drawings shall be red lined on two sets. Division 23 as-built drawings shall include updated architectural floor plans, and the individual mechanical systems in relation to actual building layout.

B. Maintain as-built red-lines on the job site as required in Division 01. Given the size and complexity of this project, red lining of the drawings at completion of construction, based on memory of key personnel, is not satisfactory. Continuous and regular red lining and/or posting of drawings is considered essential and mandatory.

C. In addition to the stated requirements for operation and maintenance data, provide one copy of equipment technical literature, operation and maintenance literature, and shop drawings to the Commissioning Agent as soon as they are available. This requirement is for review of these documents prior to distribution of multiple copies for the Owner's final use.

3.9 SOFTWARE:

A. This Contractor shall supply the Commissioning Agent with two debugged printouts of all facility management systems software, including all users programming and engineering manuals required to interpret the software. Included in the printouts, though not limited to, shall be the following:

1. Point data base
2. All custom control programs written in the BAS control language
3. All parameters required for proper operation of BAS control and utility firmware such as start/stop routines, etc.
4. System graphics

B. The software printout shall be fully documented for ease of interpretation by the Commissioning Agent and Owner, without assistance from the Contractor. English language descriptions shall be either integrated with or attached to the BAS printout. The following shall be specifically documented:

1. All point names, I/O and virtual.
2. All BAS programming language commands, functions, syntax, operators, and reserved variables.
3. Use of all BAS firmware.
4. The intended actions, decisions, and calculations of each line or logical group of lines in the custom control program(s). Sequences of operation alone are not sufficient.
5. Complete descriptions of and theories explaining all software and firmware algorithms. The algorithms to be described include, but are not limited to, PID, optimum start/stop, demand limiting, and chiller and boiler optimization.
6. A table-of-contents to the documentation which locates the sections of the documentation and describes which programs or program sections are for each piece of controlled/monitored equipment.
7. Flow charts using IEEE symbol nomenclature that demonstrates the software's algorithms and flow logic.

END OF SECTION 239900

TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 260100 - GENERAL PROVISIONS – ELECTRICAL
SECTION 260126 - DIVISION OF WORK (DIVISIONS 22, 23, 26, AND 28)
SECTION 260234 - ELECTRICAL CONNECTIONS
SECTION 260519 - CONDUCTORS
SECTION 260526 - GROUNDING AND BONDING SYSTEMS
SECTION 260529 - SUPPORTS AND FASTENERS
SECTION 260530 - CONDUIT
SECTION 260537 - SLEEVES AND PENETRATIONS
SECTION 260541 - BOXES AND ENCLOSURES
SECTION 260543 - UNDERGROUND SITE RACEWAY AND DUCTBANK SYSTEMS
SECTION 260545 - FIRE SEALS
SECTION 260553 - NAMEPLATES AND SIGNS
SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE COORDINATION
SECTION 262416 - PANELBOARDS
SECTION 262726 - WIRING DEVICES
SECTION 262727 - COVER PLATES
SECTION 262813 - FUSES
SECTION 262816 - SAFETY DISCONNECT SWITCHES
SECTION 263200 - STANDBY POWER SYSTEMS
SECTION 263214 - AUTOMATIC TRANSFER SWITCHES
SECTION 264100 - FACILITY LIGHTNING PROTECTION
SECTION 264300 - SURGE PROTECTIVE DEVICES
SECTION 265000 - BUILDING LUMINAIRES
SECTION 265400 - OCCUPANCY SENSOR LIGHTING CONTROL SYSTEMS
SECTION 269000 - PROJECT CLOSEOUT
SECTION 269990 - ALTERNATES

SECTION 260100 - GENERAL PROVISIONS – ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. The work covered by Division 26 of these specifications consists of furnishing all labor, equipment, supplies, and materials, and performing all operations, including trenching, backfilling, cutting, channeling, chasing, and patching necessary for the installation of complete wiring systems in accordance with the contract documents.

B. The Contract Drawings indicate the extent and general arrangement of the electrical work. The drawings and specifications shall be considered supplementary, one to the other, so that materials and workmanship indicated, called for or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. All labor and material required to perform all work in conjunction therewith whether indicated or specified shall be furnished and installed as part of this work.

C. See section 260111 for outline of electrical work.

D. The electrical subcontractor may also be referred to in this specification as electrical contractor. The electrical contractor may also be referred to in this specification as "this contractor", "contractor", Contractor, or "Division 26 contractor".

1.2 WARRANTY:

A. The electrical work shall be guaranteed for one-year against all deficiencies as specified in the General Conditions. In addition, the following special items shall carry an extended warranty, as indicated:
   1. Occupancy Sensor Controls: 5 years
   2. Dimming Systems: 2 years
   3. LED Luminaires: 5 years

   (* - unless all lamps are replaced at Beneficial Occupancy)

B. Any other item identified in the general conditions of the contract to have extended warranty.

1.3 DRAWINGS AND SPECIFICATIONS:

A. It is understood that while drawings shall be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear in the Contract Documents will be fully explained if application is made to the Architect in accordance with the General Conditions and Supplements thereto. However, should conditions arise where, in the judgment of the Contractor, certain changes will be advisable, the Contractor shall communicate with the Architect and secure his review of these changes before proceeding with the work, provided they are of a major nature.

B. The drawings are diagrammatic and are not intended to show each conductor, fitting, box, device, conduit, or a complete detail of all the work to be performed but are for the purpose of illustrating the type of system and special conditions necessary for the experienced electrician to take off his material and lay out his work. The Contractor shall be responsible for making such measurements as may be necessary at the Project and adapting his work to the project conditions.

C. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor, and ceiling to ensure proper rough-in and installation of work.

1.4 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. The following specifications and standards, as applicable to the materials and methods specified, shall be considered part of these specifications:

1. AEIC American Association of Edison Illuminating Companies
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials
4. ETL Electrical Testing Laboratory
5. ICEA Insulated Cable Engineers Association
6. IEEE Institute of Electrical and Electronic Engineers
7. IESNA Illuminating Engineering Society of North America
8. NCSBC North Carolina State Building Code
9. NEC National Electrical Code
10. NEMA National Electrical Manufacturers Association
11. NESC National Electrical Safety Code
12. NETA International Electrical Testing Association
13. NFPA National Fire Protection Association
14. UL Underwriters' Laboratories Inc.
15. OSHA Occupational Safety and Health Standards

B. All referenced manufacturer's requirements and specifications and nationally recognized and accepted standards and specifications shall be the currently adopted edition unless specified otherwise and shall be used as they are applicable for products and craftsmanship incorporated in the Contract Drawings and this Section only. The references to these standards

and specifications do not imply acceptance of all products described in the standards and specifications.

1.5 APPLICABLE REGULATIONS:

A. The installation shall comply with the applicable rules of the National Electrical Code and rules and regulations of the NCSBC. In no case shall the materials and workmanship fail to meet the minimum requirements of the National Electrical Code.

B. The requirements of the Power Company governing services connections, interruptions of power and metering provisions shall be part of Division 26 - Electrical work.

C. An electrical inspection certificate shall be issued by the inspection authority having jurisdiction before work is to be approved for final payment.

D. The critical electrical systems in the building and all fixtures and equipment shall be anchored and installed to withstand seismic disturbances of a magnitude characteristic to the Seismic performance category to the extent required by NCSBC.

1.6 SUBMITTALS:

A. All submittals shall be reviewed, corrected as necessary prior to submitting to Architect/Engineer and stamped "Approved" by the contractor.

B. Materials List:
   1. As soon as practicable and within 14 days after the date of award of contract and notice to begin work, and before commencement of installation of any materials or equipment, submit six copies of a complete schedule of the materials and equipment proposed for installation and of names of specialty subcontractors for approval by the Architect/Engineer.

C. The schedule shall, as soon as possible, be supplemented by catalog cuts, diagrams, lighting fixture brochures, shop drawings, field working drawings and such descriptive data as may be required by the Architect/Engineer. In the event any items of materials or equipment contained in the schedule fail to comply with the specification requirements, such items will be rejected.

D. Where shop drawings are called for in other sections of the specifications, the list shall name the manufacturer and item and state "Shop Drawings to Follow".

E. The Architect/Engineer shall be notified immediately - in writing, of delivery scheduling of the material not ordered for immediate shipment. The first payment estimate will not be approved until the Architect/Engineer is satisfied that all material is ordered, and delivery scheduled so that there will be no delay to the job because of getting material. The contractor may be required to remove and replace at his own expense any material installed before approval.

F. Shop Drawings:
   1. Shop drawings shall be submitted conforming to the requirements stated in Divisions 26, and 01-General Requirements and in the supplementary general conditions for the following items:
      a. Panelboards
      b. Lighting Fixtures
      c. Disconnect Switches
      d. Special Electrical Systems
      e. Lighting Controls
      f. Seismic Attachments, if required
      g. Additional items as specified in technical sections.

G. Field Coordination Drawings:
   1. Submit field coordination drawings in cooperation with mechanical contractor, as specified in Supplementary General Conditions, Article 14, Section C. Include, as applicable, lighting fixtures, panelboards, conduit larger than 1 inch diameter, projection screens, in-ceiling projectors, receptacles, and outlets. The drawings shall be produced with a ¼" =1 ft. scale, utilize a separate color for each trade, and be produced in the following order to help prevent space conflicts and subsequent drawing revisions. Of special importance is the final location of receptacles and outlets in special walls, like wood finished walls, to arrive in a logical and visually location of these outlets in accordance with the type of wall panel being submitted. The field coordination drawings shall include the proposed routing of the outdoor power and telecommunications conduits.
   2. Submit ¼ inch – 1'-0" scaled plans of each electrical equipment room indicating locations of electrical gear, sleeves, and conduit penetrations. Coordinate with structural system installer and provide steel framing or reinforcing steel as required to maintain integrity of structural systems.

H. Factory Record Drawings:
   1. Submit three copies of factory final record drawings for panelboards, automatic transfer switches, engine generator sets and other specified power gear.

I. Installation Instruction:
   1. Submit to the Architect/Engineer manufacturer's installation, operation, and maintenance instructions for all electrical protective or operable equipment immediately after the completion of the job. Submit four copies of complete manufacturer's instructions, other than shop drawings, for the following equipment.
      a. Panelboards
      b. Circuit Breakers, including time current for all circuit breakers over 100 amperes.
      c. Lighting Controls

J. Operation and Maintenance Manuals:
   1. See General Conditions and Supplements thereto. The contractor shall compile and bind 3 sets of all operation and maintenance manuals, equipment and parts lists, instructions, and descriptive literature furnished by the manufacturers of the furnished equipment to assist in the proper maintenance and operation of equipment. These instructions shall be turned over to the architect with application for final payment, and final payment will

not be made until received. Each brochure shall include 1 copy of each of all approved shop drawings, catalog pages, instruction sheets, operating instructions, installation and maintenance instructions, and spare parts bulletins.

1.7 EQUIPMENT SIZES:

A. Listing of a manufacturer as a source of acceptable equipment does not relieve the contractor and the manufacturer of this equipment from the requirement of meeting all aspects of the contract documents including that of having to fit the equipment in the space allocated.

1.8 WARRANTY:

A. The electrical contractor shall guarantee by his acceptance of this contract that all work installed will be free from all defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified. If during the period specified under the General Conditions of the contract and in the supplemental general conditions and as otherwise specified in Division 26, any such defect in workmanship, material or performance appears, the electrical contractor will, without cost to the Owner, remedy such defects within a reasonable time as specified in notice from the Architect/Engineer.

1.9 SITE INSPECTION:

A. Each electrical bidder shall visit the site of the work and familiarize himself with the character and conditions of the job site. The Contractor shall not be excused from doing required work because he or she did not visit the site.

1.10 RECORD DRAWINGS:

A. At the completion of the project the Contractor shall provide one set of original contract documents, and corrected record drawings in paper media to the Architect/Engineer for his preparation of record drawings. In the submitted drawing set, each change shall be marked in a clear, legible manner, keying it to the appropriate change order, clarification note, or field authorization note, as applicable. The use of the field coordination drawings is not allowed for record drawings.

B. Contractor’s electrical record drawings shall be submitted within 30 days after the date of building acceptance, as required by ASHRAE Standard 90.1.

1.11 TEMPORARY FACILITIES:

A. Temporary facilities shall be provided as required, as specified in the Division 01 - GENERAL REQUIREMENTS.

1.12 CONSTRUCTION UTILITIES:

A. Refer to DIVISION 01 - GENERAL REQUIREMENTS

1.13 CONCRETE WORK:

A. Concrete work for electrical equipment foundations, curbs, bases, pads, and pedestals shall be provided under Division 26 in conformance with Division 03 - Concrete.

1.14 METAL FABRICATIONS:

A. Steel frames, supports and metal assemblies necessary for the installation of electrical systems shall be provided under Division 26 in conformance with Division 05 - Metals.

1.15 PAINTING:

A. All equipment, except where otherwise specifically noted, shall be furnished with factory applied and baked finish coats. All galvanized steel tubs for surface mounted panels, etc. and all conduit that requires finish painting shall be properly cleaned, treated, and field painted with one coat of primer. All prime coated equipment shall be touched up where prime coats are chipped, scratched, or otherwise damaged. All prime coated equipment shall be thoroughly cleaned and left ready for finish painting.

B. Field applied prime coats shall conform to requirement specified in Division 09. Factory and shop applied prime coats shall be compatible with finish coats specified in Division 09.

C. No painting will be required on items located in unfinished electrical closets.

D. No painting will be required on factory finished items, except that any damaged or abraded areas shall be touched up to match surrounding finish.

E. Provide finish painting of all raceways not concealed by ceilings or walls, unless being painted under other sections of this specification. Finish coats shall conform to painting sections of Division 09.

1.16 EXCAVATION AND BACKFILL:

A. Excavation and backfill for raceway trenches shall be performed under Division 26.

B. Excavation and backfilling shall comply with requirements of Division 31.

1.17 ALTERNATES:

A. Electrical alternates, if applicable, are listed in the Supplementary General Conditions and in Division 26 Alternate section.

1.18 ABBREVIATIONS:

A. The following abbreviations may be found in this specification and in the drawings.

1.	A	Ampere
2.	AC	Alternating Current
3.	A/E	Architect/Engineer
4.	ADA	Americans with Disabilities Act
5.	AEIC	Association of Edison Illuminating Companies
6.	ANSI	American National Standards Institutes, Inc.
7.	ASTM	American Society for Testing and Materials
8.	ASYMM	Asymmetrical
9.	ATS	Automatic Transfer Switch
10.	AWG	American Wire Gauge
11.	C	Conduit
12.	CBM	Certified Ballast Manufacturers
13.	CFM	Cubic Feet per Minute
14.	DB	Decibel
15.	DC	Direct Current
16.	EMT	Electrical Metallic Tubing
17.	ETL	Electrical Testing Laboratories
18.	F	Fuse or Fahrenheit, as applicable.
19.	GFI	Ground Fault Interrupter
20.	HZ	Hertz
21.	IB	Intelligent Buildings, Inc.
22.	IEEE	Institute of Electrical and Electronic Engineers
23.	IMC	Intermediate Metal Conduit
24.	KCMIL	Thousand Circular Mils
25.	KV	Kilovolt (1000-volt)
26.	KVA	Kilovolt Ampere
27.	MA	Milliampere
28.	MCM	Thousand Circular Mil or KCMil
29.	NCSBC	North Carolina State Building Code
30.	NEC	National Electrical Code
31.	NEMA	National Electrical Manufacturers Association
32.	NFPA	National Fire Protection Association
33.	NOC	Normally Open Contact
34.	NCC	Normally Closed Contact
35.	PDU	Power Distribution Unit for UPS Power
36.	PVC	Polyvinyl Chloride
37.	RMC	Rigid Metal Conduit
38.	RMS	Root Mean Square
39.	RNMC	Rigid Non-Metallic Conduit
40.	RS	Rapid Start
41.	SCO	State of North Carolina State Construction Office
42.	SYMM	Symmetrical
43.	UL	Underwriters' Laboratories, Inc.
44.	UPS	Uninterruptible Power Supply System

PART 2 - PRODUCTS

2.1 MATERIALS:

A. All materials used in this work shall be new unless otherwise noted. All materials used on this project shall be listed and labeled by one of the third-party agencies which have been approved by the North Carolina Building Code Council to safety test and label electrical and mechanical equipment. Any material installed that is not labeled shall be subject to a field evaluation by one of these approved agencies, at the contractor's expense, if requested by the authority having jurisdiction or the Engineer. Any item not approved by the agency shall be replaced by the contractor at his expense. It shall be the contractor's responsibility to verify that materials specified or used on the project are labeled.

B. Catalog numbers and trade names in these specifications and noted on the drawings are intended to describe the material, devices or apparatus wanted.

C. Where "or equivalent as accepted by the Architect/Engineer" is specifically noted in the specifications, reference to any article, device, product, material, fixture, or type of construction by name, make or catalog number, such reference shall be interpreted only as establishing a standard of quality and shall not be construed as limited competition. The Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect expressed in writing is acceptable as equivalent to that specified.

D. The contractor shall immediately upon request present samples and test data from a recognized independent testing laboratory of the proposed substitute items so that the Architect's judgment may be based upon comparison of actual items rather than just catalog cuts.

E. The Architect/Engineer may request that the Contractor provide full sized model of the proposed material or assembly, at a location convenient to the Engineer/Architect for a complete evaluation. All presentations shall be made by the Contractor's representative and not by the representative of the manufacturer of the equipment.

F. Materials from listed manufacturers shall only be acceptable if they can properly fit in the allocated spaces without interference from building walls, ceilings, piping conduit, ducts, or other equipment.

G. The manufacturer shall review the use, details, and methods of installation of his product as indicated and shall disclose to the Architect all deviations from his recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

PART 3 - EXECUTION

3.1 PHASING AND SEQUENCING OF WORK:

A. Schedule work to satisfy construction expeditor, construction schedule and phasing of work.

3.2 DIMENSIONS:

A. Electrical equipment, fixtures and plans are not to be scaled. Necessary dimensions shall be obtained from architectural and structural drawings. If work is being done within existing buildings or structures, verify by field measurements all dimensions and plans shown on drawings.

3.3 DEVICES AND EQUIPMENT MOUNTING HEIGHTS

A. Unless noted otherwise, the following requirements apply to this work. In case of conflict between these stringent mounting heights and other information expressed in the contract documents, request clarification from A/E prior to starting any work.

B. Specific Requirements:
   1. Set all recessed boxes with edges flush with finished surface.
   2. Immediately after installation, cover raceways and boxes to prevent entrance of foreign matter, paint, etc.
   3. Contractor shall coordinate with other trades, and shall study the architectural plan drawings, casework drawings, etc. to determine proper placement and mounting heights of all devices. The A/E representative shall be consulted concerning any possible location problems.
   4. Do not install outlets back-to-back, regardless of what may appear to be shown on drawings. Outlets installed on opposite sides of same wall shall be installed not less than 12" apart as viewed on plan, and 24" apart if wall is fire rated.

C. Where not shown or required otherwise, the following “standard” mounting heights and positions shall apply:
   1. Boxes beside doors shall be mounted so edge of trim plate is 2” from edge of door trim on strike side.
   2. Panelboard enclosures 6’-4” (plus or minus 4” in concrete block construction) from finished floor to top of can
   3. When multiple switches are mounted side-by-side on same wall, all devices shall be mounted at the same height (does not include receptacle/telephone).
   4. Where receptacles, telephone outlets, etc., occur over counter tops, etc., if location dimensions are not shown on the drawings, consult with A/E representative.

D. In any case all devices shall be mounted in conformance with the Americans with Disabilities Act and the NCSBC. Any discrepancies with the ADA Guidelines and the drawings are to be discussed with the A/E representative prior to initiating work.

3.4 FIRE AND SOUND PROTECTION:

A. Do not install outlets back-to-back, regardless of what may appear to be shown on drawings. Outlets installed on opposite sides of same wall shall be installed not less than 12" apart as viewed on plan and 24" apart if wall is fire rated, unless suitable fireproofing protection is provided, as specified in Section 26 05 41.

B. Provide additional fire proofing, either by spray-on fire proofing type method, by applying gypsum board layers, or by any other approved method, as required to maintain fire rating of overhead slabs where floor boxes are to be installed.

3.5 WORK OBSERVATIONS:

A. Contractor shall cooperate with architect/engineer during the performing of project observations and project punch lists during the construction and post-construction (warranty) periods. Electrical work shall not be covered until reviewed by the A/E. Contractor shall open and close equipment doors and equipment cover, as required to gain access to equipment for observation by the architect/engineer as many times as requested. Provide qualified electricians to assist architect/engineer during observations and while performing punch listings.

3.6 SUPERVISION AND COORDINATION:

A. Installation of electrical conduits, boxes and equipment shall not interfere with access to HVAC and plumbing equipment, its controls, or its maintenance. Adjust locations of conduit, cable trays and light fixtures, as required to avoid blocking HVAC equipment controls.

B. Relocation of equipment, conduit, boxes, system connections or rough-in locations up to twenty feet in any direction, if necessary, to avoid conflicts with structure, ceilings, HVAC, fire protection, plumbing or architectural features shall be done at no additional cost to the Owner or his agents if identified before roughing-in.

C. The Contractor shall always have in charge of the work during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract. Anyone deemed not capable by the Architect/Engineer shall be replaced immediately upon request, and after a satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Engineer.

D. Electrical contractor shall cooperate with other contractors and subcontractors to allow for the installation of their work as well as his own.

E. The electrical contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this Contractor without regard for the work of others, or if a conflict results, must be changed as directed by the Architect/Engineer without additional cost to the Owner.

F. The Architect/Engineer reserves the right of observing all concealed work, before being covered. This Contractor shall notify the Architect/Engineer of the need of a job observation at least two working days prior to concealment of work.

3.7 CUTTING AND PATCHING:

A. This Contractor shall do all cutting, patching, and core-drilling necessary for the proper installation of his work and shall repair any damage done by himself or his workmen. Refer to field coordination drawings paragraph for additional requirements.

B. Required excavation for installation of all electrical work shall be provided by the electrical contractor and replacement and compaction shall be performed according to other specifications relating to the work.

3.8 WASTE MATERIALS:

A. The Contractor shall always keep the premises free from accumulation of waste materials or rubbish caused by his employees or work. At the completion of the work, he shall remove all leftover materials, equipment and debris resulting from the work done under this Division.

B. Waste that is classified by law, state, or Federal agencies as hazardous or toxic, like fluorescent lamps, ballasts, or other equipment containing PCB's, shall be discarded through bonded hazardous waste disposal facilities utilizing methods prescribed by law.

3.9 ACCESS TO EQUIPMENT:

A. All equipment shall be installed in location and manner that will allow for convenient access for maintenance and inspection. Adjust location shown on drawings for placement of electrical equipment to assure that the required NEC clearances are maintained.

B. Access doors and panels in walls and ceilings shall be provided as required for concealed equipment, controls and boxes, and all other items under Division 26 requiring accessibility for operation and maintenance. Doors and panels shall be provided conforming to Section 260541 under Division 26 -Electrical.

3.10 COORDINATION OF WORK:

A. The Contractor shall coordinate the work under his contract as to avoid conflicts between his work and the work of other trades. Contractor shall carefully examine the drawings prior to running any conduit and shall be responsible for the proper fittings of materials and equipment into the space provided prior to installing any conduit or equipment in accordance with requirements of the National Electrical Code. If any departures from the contract drawings are deemed necessary by the Contractor, detail drawings of such departures and the reasons therefore shall be submitted as soon as practicable to the Architect/Engineer for his review. No such departures shall be made without this review and written clarification or change order.

3.11 FIELD COORDINATION DRAWINGS

A. Submit field coordination drawings as specified in Section 260100, Part 1 prior to starting any work. Any variations in the location of equipment, light fixtures and outlets, or variations in the routing of feeders, branch circuits, or conduits, required to accomplish the installation in accordance with the field coordination drawings shall be considered as part of the original contract, if they do not exceed 20 feet in any direction from the original location. These drawings are intended to reflect actual installation of mechanical and electrical systems. Electrical items interfering with work under other trades shall be relocated as required to avoid conflict, at no extra cost to the Owner or its agents. No rough-in shall be accomplished until these drawings have been approved by the A/E. These drawings shall not be used for record drawings submittal. As part of this submittal, coordinate with structural system installer prior to making any holes through floors or structural walls.

3.12 TESTS:

A. Load Tests:
   1. A full-scale test with all lights, equipment, and appliances in operation shall be conducted by the Contractor at his expense, and the electrical system shall be proven satisfactory for operation and free from defects. Particular attention shall be paid to the balancing of the single-phase loads on the three-phase system. All defects shall be promptly remedied.

B. Insulation Resistance Test:
   1. All wiring shall be installed so that when completed, the system will be free from short circuits and from grounds other than as required by the National Electrical Code. In order that a reasonable factor of safety may be provided, insulation readings shall be made on all feeders and branch circuits sized #3 AWG or larger with a 500-volt megger after all panelboards, switches, starters, fixtures, devices, etc. are in place. Minimum resistance readings shall be as follows:

Conductor Size	Resistance
No. 14 AWG through No. 6	1,000,000 OHMS
No. 4 AWG and larger conductors	250,000 OHMS

C. Test shall be conducted between conductors and between conductors to ground. Where insulation resistance test does not meet the above values, the contractor shall either replace the conductor or correct the problem and then retest it.

D. The contractor shall submit the test results of each feeder sized #6 AWG and larger to the engineer prior to the final inspection. At the final inspection the contractor shall furnish a megger and verify any test result requested by the engineer.

E. Equipment Tests:
   1. All control devices, breakers, switches, contactors motor starters, contactors and relays shall be adjusted to operate smoothly without chatter and excessive hum.
   2. The electrical contractor shall insure that the phasing sequence is the same throughout the entire electrical system.

3.13 INTERRUPTION OF ELECTRICAL UTILITIES:

A. Any necessary shutdown of electrical or other utilities must be cleared with the Owner at least 48 hours in advance. If necessary, work must be done at night, over the weekend, or during holidays to avoid interruption during regular working hours.

3.14 COORDINATION WITH POWER COMPANY:

A. Contractor is responsible for coordinating power delivery to building with Power Company, including but not limited to the following tasks:
   1. Submitting power load information utilizing load tabulation obtained from A/E.
   2. Serving as Owner's agent in the request for power delivery.
   3. Coordinating with Power Company on routing of primary cables and requirements for primary conduit, grounding, and concrete pads.
   4. Scheduling work with Power Company.

3.15 FIRE PROOFING

A. It is the responsibility of this contractor to provide all additional fire proofing required to maintain the fire resistance integrity and rating of floors, walls and ceilings that may be compromised by the installation of conduits, raceways, boxes, and electrical cabinets.

END OF SECTION 260100

SECTION 260126 – DIVISION OF WORK (DIVISIONS 22, 23, 26, and 28)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section delineates the DIVISION OF WORK between Division 23 and Division 26. The same rules described for Division of Work between Divisions 23 and 26 apply to Division of Work between Division 21 and Division 26 and between Division 22 and Division 26.

B. Specific work to be done under Division 26 is here in after listed or described. All other work necessary for the operation of Division 23 equipment shall be performed under Division 23.

1.2 DIVISION OF WORK:

A. All individual motor starters for mechanical equipment (fans, pumps, etc.), shall be furnished and installed under Division 23. Motor starters for mechanical equipment which are scheduled as part of motor control centers, if any, shall be provided under Division 26 - Electrical.

B. Under Division 26, generally, power wiring, including line power wiring to some Division 23 control panels, shall be provided up to a termination point consisting of junction box, trough, starter, VFD, or disconnect switch. Under Division 26, line side terminations shall be provided. Wiring from the termination point to the mechanical equipment, including final connections, shall be provided under Division 23. However, whenever a direct connection to Division 23 equipment is shown electrical contractor shall provide final connection.

C. Duct smoke detectors shall be furnished under Division 28, installed by Division 23, and wired under Division 28. Fire alarm AHU shut down control circuits shall be wired from auxiliary relays in the fire alarm control panel, to a termination point adjacent to AHU equipment controller under Division 28 as directed by HVAC controls contractor. Wiring from the termination point to the equipment controller shall be under Division 23.

D. Power and control wiring for equipment rated at 115 volts and less, and for all relays, actuators, including motorized dampers, timers, seven-day clocks, alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations, and interlocking devices, shall be provided by the contractor or subcontractor furnishing the equipment or control item. Power wiring of disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 23 shall be furnished, installed, and wired under Division 23.

E. All wiring required for power, controls, and instrumentation for Division 23 systems, not indicated on the electrical drawings, shall be furnished and installed by Division 23.

F. Additional power wiring required for HVAC equipment over and above what the electrical drawings show shall be provided by the HVAC contractor.

~~G.~~ 120 Volts, 60 Hz power supply for Division 23 control functions, if not shown on electrical drawings being directly provided, or provided in adjacent junction box by Division 26, shall be provided under Division 23 utilizing spare circuit breakers in branch circuit panelboard with type of power compatible with the control function.

H. Roof exhaust fans with built-in disconnects provided under Division 23 shall be wired under Division 26 to the disconnect. Roof exhaust fans and other HVAC equipment controllers without built-in disconnect switches will be provided with separate disconnect switch under Division 26. Wiring from the switch to the equipment shall be under Division 23. Division 23 equipment furnished with auxiliary unwired built-in outlets shall be wired under Division 26 to the line side of the outlet.

~~I.~~ Exit doors and other doors provided with built-in outlets shall be wired by the Electrical Contractor all the way to the door outlet.

J. Reports showing the sizes of the maximum overcurrent protection (MOCP) and the maximum circuit ampacity (MCA) and overload setting of the devices for all motors, shall be provided by the Contractor providing the equipment to this engineer before project final approval.

K. All electrical work shall be performed by companies properly licensed by the NC State Electrical Board of Examiners.

L. Power for motorized dampers shall be provided by Division 23 from 120-volt circuits provided by Division 26 in designated junction boxes. Division 23 Contractor shall extend the 120-volt circuit to the damper and shall connect each motorized damper via individual toggle switch. Multiple dampers shall share the same 120-volt circuit.

END OF SECTION 260126

SECTION 260234 – ELECTRICAL CONNECTIONS

PART 1 - GENERAL

1.1 SCOPE:

A. The Electrical Contractor shall provide power wiring and final electrical connection to all equipment requiring electrical power.

1.2 CONTROL WIRING:

A. Control wiring for equipment not provided under this Section, unless specifically called for on the electrical drawings will be provided by the contractor furnishing the equipment.

1.3 EQUIPMENT CONNECTIONS:

A. Final Equipment connection shall be the responsibility of this Contractor.

B. The Electrical Contractor shall provide full and final connection to all equipment furnished by Owner requiring electrical connections.

PART 2 - PRODUCTS

2.1 MOTOR CONTROLLERS:

A. All motor controllers for Divisions 21, 22 and 23 equipment shall be provided by the Contractor furnishing the equipment.

2.2 DISCONNECT SWITCHES:

A. All required disconnect switches, except those integral with controllers furnished under other contracts, shall be furnished by the Electrical Contractor.

B. Disconnect switches for single phase motors through ½ horsepower shall be 20-ampere AC rated toggle switches. Disconnect switches for single phase motors larger than ½ horsepower shall be manual starters of matching horsepower rating.

C. Disconnect switches for 3-phase motors and heating loads shall be knife type safety switches, as specified in Section 262816.

PART 3 - EXECUTION

3.1 RACEWAY CONNECTIONS:

A. Equipment connections shall be made through raceway as previously specified except that connections to motor and appliances in other than return air plenums shall be through liquid tight flexible metal conduit with grounding conductor, as applicable. Use regular flexible metallic conduit in spaces above ceilings used as return air plenums. Flexible conduit connections, other than as otherwise specified in Section 260530, shall be not less than 12 inches but not more than 36 inches in length.

3.2 COORDINATION:

A. It shall be the responsibility of the Electrical Contractor to verify adequacy of supply wiring, overcurrent protection, proper voltage, phase rotation, maximum temperature rating of branch circuit conductor, and final location of the equipment provided by the Owner and under other sections of these specifications prior to the running of any conduit or wiring. Report to the Architect/Engineer any discrepancy or mismatch between equipment being connected and incoming branch circuit or feeder.

END OF SECTION 260234

SECTION 260519 – CONDUCTORS

PART 1 - GENERAL

1.1 SCOPE:

A. Requirements of Section 260100 shall apply.

B. This Section applies to secondary power and signaling conductors for systems rated 600 volts and below.

C. A complete system of conductors shall be installed in the raceway systems as specified here and shown on drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 260530 - Conduit

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. Compliance: The materials specified here shall meet the following specifications and standards in their current edition.
   1. UL Standards:
      a. Insulation tape
      b. Wire Connectors and Soldering lugs
   2. NEMA Standards:
      a. Thermoplastic - Insulated WC 70 (ICEA S-95-658-1999)

B. General:
   1. All wire and cable shall be listed by an “approved” third party testing agency.
   2. Prior to energizing, feeders, sub-feeders, and service conductor cables shall be tested for electrical continuity and short circuits. A copy of these tests shall be sent to the A/E prior to energizing cables.
   3. All wire and cable shall be run in raceway, unless otherwise specifically noted.

PART 2 - PRODUCTS

2.1 CONDUCTORS:

A. All conductors shall be made of copper, except as otherwise noted. All wire shall be new, manufactured within 6 months of project award. If requested, contractor shall provide manufacturer’s certification giving date of manufacture.

B. Conductors, unless otherwise noted, shall be heat and moisture resistant grade, thermoplastic insulated. Conductors No. 8 AWG and larger shall be stranded copper conductors, dual rated, Type THHN-THWN; Conductors No. 10 and smaller shall be solid copper, Type THHN-THWN (dual rated), or XHHW, except as otherwise required below. Branch circuit conductors for connection to lighting fixtures shall have a temperature rating of not less than what is required by the UL listing of the fixture with a minimum rating of 90 degrees C.

C. Except as otherwise noted in technical specification sections, conductors for signal and control circuits above 50 volts AC may be THWN-THHN as permitted by NEC, No. 14 AWG. Conductors for signal and control circuits below 50 volts AC or DC may be 300-volt, PVC insulated, No. 14 AWG, unless otherwise noted in corresponding technical section.

D. Branch circuit conductors shall be not smaller than No. 12 AWG, except as noted here or on the drawings. Conductors for branch circuits whose length from panel to the first outlet in the circuit exceeds 50 feet for the 280/120-volt system shall not be smaller than No. 10 AWG, but not smaller than what is scheduled on panelboard schedule. Oversized conductors feeding multi-outlet assemblies may be reduced, at the outlet box used to feed the multi-outlet assembly, to a size conductor rated to match the circuit breaker ahead of the circuit, if the use of the larger conductors will exceed the wiring capacity of the assemblies.

E. Insulated grounding conductors exposed in spaces used for air return shall be listed for the application.

F. Maximum conductor size allowed shall be 500 KCMIL.

G. Conductors being connected to transformers and other equipment shall have a temperature rating as required by the transformer or equipment manufacturer.

H. Fire alarm system conductors shall be stranded.

I. MC, AC, or “BX” cable shall not be allowed.

J. Power wiring from Variable Frequency Drive Controllers (“VFD”) to motors shall be accomplished by using 3-phase, 3 ground, copper tape spiral shield, galvanized steel interlocked Armor cable for the VFD cable. To ensure system reliability, the cable shall be terminated in connector designed exclusively for ASD/VFD cable. This cable will be furnished and installed as part of Division 23 – HVAC work.

2.2 COLOR CODING:

A. Conductors, feeders, and branch circuits shall be color coded by phases as follows:
   1. 208/120 volts systems: Phase A-black; Phase B-red; Phase C-blue; Neutral-white; Grounding wire-green.
   2. Insulating tape of proper color shall be used to identify the phase conductors #4 AWG and larger conductors.
   3. Conductors #6 AWG and smaller shall have factory color coded insulation.

4. All feeders, sub-feeds to panels, motors, etc., shall be completely phased out as to sequence and rotation. Phase sequence shall be A-B-C from front to rear, top to bottom, left to right when facing equipment.

B. Provide color coding diagram on each piece of power distribution equipment as required by NEC 210.5(c).

PART 3 - EXECUTION

3.1 SPLICES:

A. Solid Conductor Splices:
1. Solid conductors namely those sized #10, #12, and #14 AWG copper, and smaller, shall be spliced by twisting securely and by means of Ideal wing nuts, 3M Company's Scotchlok or T&B's splice connectors for branch circuits (#10 and #12) in junction boxes and light fixtures, except recessed fixtures as noted. The contractor shall use Ideal 'wire-nuts' for recessed lighting fixture lead splices to branch circuit conductors.

B. Sta-Kon or other permanent type crimp connectors shall not be used.

C. Stranded Conductor Splices:
1. Namely #6 AWG and larger, shall be spliced by approved mechanical pressure type connectors or lugs plus gum rubber tape or friction tape. Solderless mechanical connectors, for splices and taps provided with U.L. approval insulating covers, may be used instead of mechanical connectors plus tape. Circuit joints shall not be made with terminal screws of wiring devices.

3.2 SPLICES IN WET LOCATIONS

A. Splices in wet locations like within manholes, handholes or outdoor junction boxes shall be made as specified above except that splice shall be insulated utilizing UL listed insulation kit suitable for wet locations. Submit proposed kit information along with manufacturer’s installation requirements for approval by A/E.

3.3 INSTALLATION OF CONDUCTORS:

A. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes, troughs, and gutters. Pull boxes may be utilized where required. If other than long radius bends are required, pull boxes sized in accordance with the NEC shall be used. Location of feeder pull boxes shall be subject to approval by A/E and shall be included with installation drawing submittal specified under Section 260100 - General Provisions - Electrical.

B. Conductors in vertical runs shall be supported as required by NEC 300-19 utilizing listed and approved support fittings.

C. Conductors shall be labeled within all junction boxes, etc. using plastic “punch” tape identifying the conductors according to circuit numbers.

D. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise to be forced closed as screw is tightened. Only one solid wire loop may be held under a single screw.

E. Make all connections tight. Torque-tighten all connections to lugs per manufacturers and UL requirements.

F. Wires within panel boards, terminal cabinets and similar equipment shall be neatly squared, bundled together, and held with plastic ties.

G. Where “paralleling of conductors” is shown for feeders or service entrance, it is required they be the same length between points of bonding together.

H. Provide a dedicated, separate neutral conductor for each circuit requiring a neutral. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted. For lighting, motor, appliance, circuits, and receptacle circuits where two or more circuits are run in the same conduit, provide a separate neutral for each circuit.

I. Do not run more than 3 single-phase, 120-volt, branch circuits, each with separate neutral, in the same conduit. All other circuits shall be run in individual conduits. Provide grouping of circuits as required by NEC. Do not mix in same conduit, conductors from different systems (i.e., 208/120 volt and 480/277 volt).

J. Circuit shall be connected to panels as shown on the drawings.

K. Under the above requirements and with required color-coding system, no feeder or branch circuit raceway shall contain more than one wire of the same color, except for switch legs and control circuits.

L. Where no indication is made of wire size, the conductor shall be sized per NEC requirements to match its overcurrent protective device, but in no case smaller than #12 AWG.

M. Unless noted otherwise, or another arrangement is approved by the Engineer, busses in panels and switchgear shall be considered A, B and C from left to right, top to bottom, or front to back when facing equipment.

N. Control and signal wiring shall not use the above-named colors except green for grounding. Any other colors or striping may be used but the coding shall provide same color or striping between any two terminals being jointed.

O. Travelers in switching circuits shall be of same color as phase conductors serving the circuits.

3.4 CONDUCTOR SEQUENCE AND ROTATION:

A. All feeders, sub-feeds to panels, motors, etc., shall be completely phased out as to sequence and rotation. Phase sequence shall be A-B-C from front to rear, top to bottom, left to right when facing equipment.

3.5 CONNECTION OF OVERSIZED CONDUCTORS TO CIRCUIT BREAKERS AND SWITCHES:

A. When oversized branch circuit conductors are scheduled to be connected to circuit breakers, or switches, not having the capability to accept the larger conductor, provide splice in suitable junction box as close as possible to circuit breaker, but not further than 10 feet from circuit breaker, equipment or device being connected, as approved by the A/E, and connect to circuit breaker with the largest conductor that fit the circuit breaker. For similar situations for feeder, or large branch circuits, (circuit breakers rated 125 amperes and larger) provide lugs as required by feeder conductors.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING SYSTEMS

PART 1 - GENERAL

1.1 SCOPE:

A. Grounding and bonding of the electrical power system.

1.2 GENERAL:

A. The power distribution system shall be grounded at each voltage level. The conduit and neutral conductors of the wiring systems and all electrical equipment shall be grounded. The ground connection of the electrical system neutral and conduit system shall be made at the main service switchboard or main power device.

B. Each conductive, non-current carrying, part of the electrical system shall be bonded to an equipment grounding conductor sized in accordance with NEC.

C. The raceway system shall not be relied on as the sole grounding path for ground continuity. A green grounding conductor, properly sized per NEC Table 250-122, shall be run in all raceways (except telecommunications, data, and audio conductor's raceway) to ground each conductive, non-current carrying part of the electrical power system. This conductor shall be bonded to each metallic conduit, box and cabinet that is part of the related power system raceway.

D. The electrical service shall be grounded in accordance with Article 250 of NEC as follows:
   1. To the main metallic water main pipe, as per NEC Article 250-52
   2. To the steel frame of the building, if any.
   3. To the foundation re-bar system
   4. To the supplementary grounding electrode system specified on the electrical drawings.

E. A copper ground conductor sized in accordance with the NEC shall be extended in appropriate raceway from the main service equipment and bonded to form the grounding electrode system required by Article 250-50 of the NEC. Connection to the water pipe shall be made by suitable ground clamp or by lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the supply side of the flange connection. Electrical bond shall be established around the water meter. A stamped metal tap with the inscription "Do not Disconnect" shall be provided at the connection to the water pipe.

1.3 GROUNDING BAR SYSTEM:

A. Equipment grounding bar shall be provided at each electrical room or closet. Grounding bars shall be connected to the service equipment grounding bus.

B. All grounding conductors shall be labeled at each grounding bar.

C. Minimum thickness and height of any installed grounding bus shall be ¼" x 2".

1.4 GROUND RESISTANCE TESTS:

A. Resistance to ground of grounding system shall be determined through ground resistance tests. The tests shall provide a true overall measurement of the resistance to ground, and of the entire physical integrity of the system.

B. Ground resistance tests shall be made in dry weather and in no case less than 48 hours after rainfall. Tests shall be conducted using the ratio method which measures the ratio of the resistance to earth on an auxiliary electrode. All measurements shall be in accordance with the Institute of Electrical and Electronic Engineers, Inc. – Fall of Potential Method.

C. The indicating instrument shall be self-contained and shall include a direct current generator, synchronized current and potential reverse, cross current and potential coils, direct reading ohmmeter, series resistors, and range selector switch. The direct reading ohmmeter shall be calibrated for ranges of 0 to 20 and 0 to 200 OHMS on a scale logarithmic in character.

D. Performance Criteria: Resistance to ground shall not exceed 5 OHMS at any point of the system as measured in accordance with the requirements of this specification and including connection to main water pipe and bonding to structural steel, if any, and to rebar system.

E. Owner must be given 7-day notice to observe the test.

F. Record of Ground Resistance Tests:
   1. A certified record of ground resistance tests on the entire system shall be prepared and submitted for compliance to the Architect/Engineer and to the Owner upon completion of the tests.
   2. The record shall be prepared and submitted for compliance to the Architect/Engineer and to the Owner upon completion of the tests. The grounding resistance test shall be performed by an independent testing company, engaged by the contractor, with not less than five years of experience in this type of work. The name of the testing company, along with its credentials shall be submitted to the Owner's representative with the contract bid. The test shall include the system connected to the main water pipe, structural steel, the rebar system and bonded to the lightning protection system.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All products shall be new and listed for the use intended.

B. Equipment grounding conductors, for other than supplementary grounding system or within spaces used as air plenums, shall have 600-volt insulation and shall be as specified in Section 260519. Use stranded bare copper cables for exposed grounding conductors within spaces used as air plenums.

C. Grounding conductors, where insulated, shall be colored solid green. Conductors intended as neutral shall be colored solid white on 120/208V circuits and natural gray on 277/480V circuits.

D. Clamps for attachment of grounding conductors to water pipes, etc. shall be of bronze or brass, with conduit hub with insulated bonding bushings and compression type lugs.

E. Ground rods shall be copper-clad steel rods not less than 3/4 inch in diameter and not less than 10 feet long. The rods shall be rolled to a commercially round shape from welded copper clad steel manufactured by the electro-forming process and shall have a hard, clean, and smooth continuous copper surface. Ground rods shall be sectional type with cone shape point and shall be die stamped near top with the name or trademark of the manufacturer and the length of the rod in feet.

PART 3 - EXECUTION

3.1 INSTALLATION AND WORKMANSHIP:

A. Conductors inside building shall be installed above non-air plenum ceilings at accessible locations, preferably mounted on walls. Conductors penetrating walls or floors shall be provided with sleeves. Support conductors at intervals not exceeding 6 feet.

B. Installation of Connectors: Connectors shall be installed in strict accordance with manufacturer's instructions.

C. Any feeder raceway anywhere in the system which enters a box or cabinet through part of a concentric knock-out shall be fitted with a bonding bushing and jumper. The jumper shall be sized per NEC Table 250-102(C)(1) and be lugged to the box.

D. Boxes with concentric, eccentric, or oversized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC Table 250-66 and lugged to the box.

E. Ground Resistance Tests: Refer to Part 1 of this specification.

F. Grounding electrode conductors shall be installed in conduit.

3.2 BONDING:

A. Bond the above ground portion of the gas piping system that is likely to become energized to comply with NEC 250-104(B) requirements. Use #4 wire or larger.

3.3 BONDING JUMPER:

A. Bonding jumper at service equipment for both equipment and conduit shall be in accordance with NEC Article 250, which for parallel conductors shall be wire or a wire not smaller than 12½% of the cross-sectional area of all parallel phase conductors added together.

END OF SECTION 260526

SECTION 260529 – SUPPORTS AND FASTENERS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Work Included: Work under this Section includes but is not necessarily limited to the following:
   1. Provide supports and fastenings required for properly mounting of all boxes, raceways, electrical equipment, and fixtures as required to meet mounting requirements of the NEC.
   2. Provide special seismic restraint certification and inspection if so required by seismic classification of building per South Carolina Building Code.

1.2 APPLICABLE PUBLICATIONS:

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. Federal Specifications (Fed. Spec.)
      a. RR-W-401F Wire Rope and Strand
   2. American Society of Mechanical Engineers (ASME) Standards.
      a. B18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws
      b. B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts
   3. American Society for Testing and Materials (ASTM)
      a. A307 Carbon Steel Bolts, Studs and Threaded Rod
      b. A576 Steel Bars, Carbon, Hot-Wrought, Special Quality
      c. F3125 High Strength Structural Bolts
   4. Underwriters Laboratories, Inc., (UL) Standards
      a. Building Materials Directory
      b. UL57 Electric Lighting Fixtures

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel Supports:
   1. Provide brackets, frames, and hangers fabricated from standard rolled structural steel shapes or prefabricated systems manufactured by one of the following:
      a. Kindorf
      b. Powerstrut
      c. Unistrut

2.2 WALL ANCHORS:

A. Interior Masonry or Concrete Walls: Expansion bolt anchors designed to match the load, seismic requirements, and type wall construction, but not smaller than 3/8".

B. Exterior Precast Concrete Walls: Expansion bolt anchors with penetrations limited as approved by Architect.

C. Interior Dry Walls: Toggle bolt anchors designed to match the load and seismic requirements, but not smaller than 3/8"

2.3 BEAM ANCHORS:

A. Install expansion bolt anchors designed to match the load and seismic requirements.

B. All anchor holes drilled in reinforced concrete beams or concrete joists shall avoid cutting the reinforcing bars.

C. All heavy loads such as transformer trapeze anchors shall be reviewed with the Architect prior to installation.

D. Manufacturer of anchor bolts, toggles, etc., shall be ITT Philips (Red-Head), Ackerman Johnson, Rawlplug Co., or approved equal.

2.4 RODS:

A. Provide threaded steel rods, where required, size as required by load and seismic requirements but not less than 3/8-inch diameter. Use hot-dip galvanized steel on installation exposed to the weather. Do not use chain except where detailed or specifically required. Do not use perforated strap or wire.

2.5 BOLTS AND NUTS:

A. Squarehead bolts and heavy hexagon nuts, ANSI B18.2 and ASTM A307 or A576.

B. Bolts, underground, ASTM A325.

C. Sway brace details shall conform to all applicable requirements of MSS Pub. SP-58 cited herein.

D. Guy wires shall conform to Fed Spec. RR-W-410, as follows:
   1. 5/32" diameter Type V, Class 1
   2. 3/16" to 5/16" diameter Type V, Class 2
   3. 1/4" to 5/16" diameter Type I, Class 2

E. Lighting fixtures and supports shall conform to UL 57.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.

B. Prior to installation of hangers, supports, anchors, and associated work, the contractor shall meet at the project site with Construction Manager, installer of each component of associated work, inspection, and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purposes of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 REPLACEMENT OR REMOVAL OF EQUIPMENT:

A. Consideration shall be given to the potential replacement or removal of equipment in the selection of anchors or fasteners. When it can reasonably be assumed that equipment will be replaced, anchors and fasteners that can be reused or replaced shall be used. When it can reasonably be assumed that equipment will be removed, anchors and fasteners that have protruding parts, such as bolts or studs, shall not be used. If the protruding part can be removed or driven flush with the base material, such anchors or fasteners may be used.

3.3 INSTALLATION:

A. Anchors and fasteners shall be installed in accordance with the manufacturer's directions. Necessary holes shall be drilled with drills recommended by the manufacturer and shall be of the recommended diameter and depth. The drilled holes shall be left rough, not reamed, and shall be free from any drill dust. Screws installed in wood or other material shall be so located as to be such distance away from joints as not to be loosened upon opening of joints with shrinkage of the material. Screws, bolts, nuts, or other devices used with anchors or fasteners shall have standard threads and heads and be of a type and size recommended by the manufacturer of the anchor or fastener being used.

3.4 RACEWAYS:

A. EMT, IMC and rigid conduit supports shall be provided at least every 8' and within 3' of each outlet box, junction box, cabinet, or fitting.

B. All pipe supports shall be of type and arrangement as hereinafter specified. They shall be so arranged as to prevent excessive deflection and avoid excessive bending stresses.

C. Provide all steel and concrete required for support and anchoring of pipes other than shown on Structural or Architectural Drawings.

D. A/E shall approve method of hanging before work is started. This contractor shall bear all responsibility for materials and workmanship as described in this section and shall make sure that all hangers and supports are properly and permanently connected to building structure.

E. All supports shall be designed to avoid interference with other conduit, hangers, ductwork, building structures and equipment.

3.5 SAFE WORKING LOAD:

A. To compensate for variations in products and job conditions, anchors, and fasteners, including screws, bolts, or other devices used with them, shall have a minimum safe working load of 1/4 of the holding power. The holding power of an anchor or fastener shall be based upon laboratory test and certified by the manufacturer. Safe working load may also be determined as 1/4 of a proof test load. A proof test load is a predetermined load that an anchor or fastener must support without failure. The actual holding power might be greater than the proof load.

B. The type of anchor or fastener to be used shall be designed and intended for use in the base supporting surface to which the item or support is to be attached. As a rule, wood screws should be used on wood, masonry anchors on concrete or brick, toggle bolts or similar on hollow or thin units, and machine screws, bolts, or welded studs on steel. Some anchors and fasteners are intended for and may be used on more than 1 base material. For example, some anchors intended for concrete may apply also to hollow masonry units. Other anchor and fastening devices specifically designed for the purpose may be used for their intended application. These include concrete inserts, continuous slot channels, beam clamps, friction, and spring clamps, etc.

3.6 ATMOSPHERE:

A. Anchors and fastenings and screws, bolts, or other devices used with them, shall have corrosion resisting characteristics for the atmospheric conditions in which they are installed. When anchors and fastenings do not inherently have the necessary protection or the protection is lost during installation, they shall be coated to furnish protection sufficient for the atmosphere. If it is not possible to provide protective coatings, such anchors or fasteners shall not be used.

3.7 RESTORATION OF STRUCTURAL AND BUILDING FIREPROOFING:

A. Restore to original condition any portion of structural or building fireproofing material damaged or removed during the installation of fastener or supports.

3.8 ANCHOR BOLTS:

A. All floor or pad mounted electrical equipment required by any section of these specifications will have a minimum of 4 anchor bolts securely fastened through bases. Anchor bolts shall have

straight length equal to at least 10 times the nominal diameter of the bolt and shall conform to the manufacturer's published installation instructions.

B. Anchor bolts which exceed normal depth of equipment foundations or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.9 EQUIPMENT SWAY BRACING:

A. Equipment sway bracing shall be provided for all items supported by off-the-floor structures or structures suspended from floors or roof above. Braces shall consist of angles, rods, bars, or pipes run at a 45-degree angle from the equipment frame to the building structure secured at both ends with not less than ½" bolts. Braces shall conform to the bracing material schedule. Bracing shall be provided in 2 plans of directions, 90 degrees apart, for each item of equipment. In lieu of diagonal bracing applied to vertical support structures from floor or roof above, items may be supported with hangers inclined at 45 degrees, provided supporting members are properly sized to support full operating weight of equipment when hangers are inclined at a 45-degree angle.

END OF SECTION 260529

SECTION 260530 – CONDUIT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Power and telecommunications conduit.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 260529 - Supports and Fasteners

B. Section 260537 - Sleeves and Penetrations

C. Section 260545 - Fire Seals

1.3 ABOVE GROUND CONDUIT:

A. Minimum size conduit for interior above-ground power circuit applications shall be 3/4 inch, except as otherwise noted. Minimum size conduit for telecom wiring is 1-inch.

B. Conduit shall be sized in accordance with the latest edition of the NEC unless larger conduit is indicated on drawings.

C. All wiring shall be in electrical metallic tubing EMT for concealed and exposed work except as otherwise noted.

D. Rigid metal conduit RMC shall be used for all stub-ups, stub-outs and transitions from RNMC.

E. Rigid metal conduit RMC or intermediate metal conduit IMC shall be used as listed below:
   1. In cinder (concrete block) walls, except as otherwise noted below
   2. Exposed to the weather, or in damp location
   3. In earth or stone
   4. In concrete slabs
   5. Where obviously subject to mechanical injury
   6. For exposed conduit in the area between floor and 6’-0” above floor in other than electrical and telecom rooms. Conduit stub-ups from underground shall be rigid steel conduit.
   7. Where specified otherwise
   8. As raceway carrying telephone or telecommunication service to demarcation point

F. Rigid non-metallic conduit RNMC may be used in the following applications only:
   1. Within CMU walls, when totally concealed by wall. In this case transition from RNMC to above ceiling space, outside of the CMU wall cavity, may be accomplished with an EMT elbow.
   2. Under slab or underground, encased in 3-inches of concrete all around.

G. Flexible metallic conduit shall not be used as a general wiring method, but for final connection to equipment, motors, and lighting fixtures. Use flexible 6-foot-long metallic conduit whip to connect to lighting fixtures.

H. Flexible non-metallic conduit or tubing shall not be permitted in this project.

I. Type AC (BX) armored cable, or MC cable, shall not be permitted in this project.

J. The raceway system shall not be relied upon as the only method for grounding continuity.

1.4 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. The materials specified here shall meet the following specifications and standards in their current edition.
   1. UL Standards:
      a. Flexible Metal Conduits-UL-1
      b. Rigid Metal Conduit UL-6
      c. Intermediate Metal Conduit UL-1242
   2. NEMA Standards:
      a. Electric plastic conduit TC-2.
   3. ANSI Standards:
      a. Specifications for Rigid Steel Conduit, Zinc Coated, ANSI C80.1.

1.5 SUBMITTALS

A. Submit details, manufacturer's information, diagrams, and product data for conduit specified here and associated fittings plus the following items:
   1. Conduit expansion joint fittings suitable for the expected expansion and deflection at the joint.
   2. Waterproof conduit fittings for both interior and exterior of conduits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Metal raceway system components shall be as manufactured by GE, Kaiser, Republic, or T&B. Non-metallic raceway system components, if shown on the drawings shall be manufactured by Carlon or Queen City Plastics.

2.2 RIGID METAL CONDUIT:

A. Rigid metal conduit shall be schedule 40 of the best quality steel.

B. The interior and exterior surfaces of the conduit shall be protected with a metallic zinc coating. Rigid steel conduit shall be galvanized by the Hot-Dip process in accordance with ASTM A 123.

C. Fittings for RMC shall be threaded type, UL listed.

2.3 ELECTRICAL METALLIC TUBING:

A. Electrical metallic tubing shall be rigid metal conduit of the thin-wall type in straight lengths, elbows or bends for use as raceways for wire or cables in an electrical system.

B. Electrical metallic tubing shall utilize hexagonal steel type compression threadless fittings of plated steel. All compression fittings shall be UL listed for concrete-tight and rain-tight construction. All EMT connector fittings shall be provided with insulated throats. Pot metal, set screw or indented type fittings shall not be utilized.

C. Use junction boxes to transition from rigid conduit to EMT and vice versa.

2.4 FLEXIBLE METALLIC CONDUIT:

A. Flexible metallic conduit shall conform to UL standard Flexible Steel Conduit. All steel used in the fabrication of the conduit shall be zinc coated.

B. Liquid-tight flexible steel conduit shall be provided with a protective jacket of polyvinyl chloride extruded over a flexible interlocked galvanized steel core to protect outdoor wiring against moisture, oil, chemicals, and corrosive fumes.

2.5 RIGID NON-METALLIC CONDUIT:

A. Schedule 40 (EPC-40), heavy wall polyvinyl chloride plastic conduit and fittings, UL listed, suitable for 90-degree C. conductors.

2.6 INTERMEDIATE METAL CONDUIT:

A. Intermediate metal conduit IMC shall be zinc coated steel, UL listed and labeled.

B. Fittings shall be the same type as for RMC.

2.7 WIREWAYS AND TROUGHS:

A. Wireways or troughs shall be of the size noted on the drawings or as required by the NEC of code gauge galvanized steel. Sizes 6-inch x 6-inch and smaller wireways and all troughs shall be of the hinged cover type except as otherwise noted on the drawings. Larger sized wireways shall be of the flangeless screw cover lay-in type. All shall be without knockout, and shall be provided with fittings, supports, and appurtenances as required.

2.8 TERMINATIONS:

A. IMC and RMC shall terminate with either a double locknut/bushing set, or in a threaded hub.

B. Where concentric, eccentric, or oversized knockouts are encountered, a grounding-type insulating bushing shall be provided.

C. All conduits shall be provided with insulated throats.

D. Flexible conduit connectors shall have insulated throats and anti-short bushings.

E. Exposed threads on galvanized conduits and fittings shall be coated with galvanized paint or equivalent protective coating for exterior applications and in damp locations.

F. EMT terminations shall be made utilizing steel-plated hexagonal compression connectors. Set screw or indented type fittings shall not be utilized.

2.9 CONDUIT COUPLINGS:

A. Split or Erickson coupling shall be OZ Gedney or approved equal.

B. Conduit couplings for RMC, IMC and PVC shall be in accordance with the NEC.

C. Flexible conduit couplings shall have UL listed insulated throats.

D. EMT couplings shall be of the plated-steel hexagonal compression type. Set screw or indented type couplings shall not be utilized.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUIT:

A. Metallic raceways shall not be stored exposed to the weather.

B. Conduit shall be securely fastened to all sheet metal enclosures with double galvanized locknuts and insulated bushings, care being observed to see that the full number of threads project through to permit the bushings to be drawn tight against the end of conduit, after which the locknuts shall be made sufficiently tight to ensure positive ground continuity between conduit and box.

C. Conduits shall be concealed within walls, ceilings, and floors, where possible, under the conditions stated in Part 1 of this section and shall be kept at least 6 inches from parallel runs of flues, steam pipes, or hot water pipes. Exposed runs of conduit and conduit run above suspended ceilings, shall have supports spaced not more than 8 feet apart and shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right-angle turns consisting of cast metal fittings or symmetrical bends. All raceways shall be run in a neat and orderly fashion. Conduits run in diagonal or disorganized way shall be removed from the premises, if so instructed by the A/E. Bends and offsets shall be avoided where possible, but

where necessary shall be made with an approved hickey or conduit bending machine. Conduit which has been crushed or deformed in any way shall not be installed.

D. Telecommunications conduit shall be installed in such a manner that no length of run shall exceed 100 feet and shall not contain more than two 90-degree bends or the equivalent. Provide insulated bushing at each end of conduit. Conduits shall be stubbed from outlet boxes to above the nearest accessible corridor ceiling.

E. Conduits and related boxes and cabinets installed on the interior side of exterior building walls shall be spaced off the wall surface a minimum of ¼ inch using "clamp-backs" or strut.

F. Conduit, junction boxes, troughs and any enclosure on exterior walls shall be mounted one inch off the wall.

G. EMT provided under roof deck shall be installed 1.5 inches or more away from the deck to allow for screws not to penetrate the EMT conduit during roofing.

H. Conduit shall be supported on approved types of galvanized wall brackets, ceiling trapezes, strap hangers, or pipe straps, secured by means of toggle bolts on hollow masonry units, expansion bolts in concrete or brick, machine screws on metal surfaces, and wood screws on wood construction. Nails shall not be used as the means of fastening boxes on conduits. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure conduit supports.

I. Conduits shall be installed in such manner as to insure against trouble from the collection of trapped condensation, and all runs of conduit shall be arranged to be devoid of traps where feasible. The contractor shall exercise the necessary precautions to prevent the lodgment of dirt, plaster, or trash in conduit, fittings, and boxes during installation. A run of conduit which has become clogged shall be entirely freed of these accumulations or shall be replaced.

J. The use of LB's shall be limited where possible. Where necessary to use LB's sized above 2-inch, mogul units shall be installed.

K. Contractor shall provide and properly install sleeves and advise other trades of required chases and openings so that they can be properly built in. No supports shall be connected to the roof without prior approval of the designated representative.

L. Seal all incoming conduits into the building with sealing fitting as specified in this section.

M. Where conduit passes through a below grade wall from a conditioned interior building space, said conduit shall be sealed utilizing fittings similar and equal to OZ/GEDNEY type FSK thru-wall fitting with FSKA membrane clamp adapter if required, or any other similar UL listed fitting.

N. Use Link-Seal or approved equal method to seal core drilled penetrations through exterior walls, if any are required.

O. Insulated bushings of molded bakelite shall be used on all conduit entrances, one inch over in size, into junction boxes, panel boxes and motors starters having sheet metal enclosures.

P. Galvanized rigid conduit GRC directly installed underground shall be coated with two coats of bitumastic paint. Conduit installed underground or in concrete on ground shall be made watertight by wrapping the joints with Teflon tape.

Q. Do not use Liquid-Tight flexible metallic conduit in air plenums.

3.2 EXPANSION FITTINGS:

A. Provide means to allow for building expansion and seismic building vibration without damage to conduit system where conduits of any type pass over a building expansion joint.

3.3 PULL WIRE:

A. Nylon pull wire shall be installed in all empty conduit longer than 10 feet. Pull wire shall be secured at each end and tagged for identification of the use of the conduit, and conduit origin and termination point.

3.4 CONDUIT PENETRATION SEALING

A. Seal all conduit penetrations through wall, floor, or roof, regardless of whether the wall or floor is rated. Conduit penetrations through floor shall be water tight. Conduit penetrations through wall shall be air tight.

3.5 CONDUIT CAPS:

A. Provide threaded caps on any conduit sleeve, or empty conduit. In addition, provide watertight plugs or fittings if conduit or sleeve is exposed to weather or water runoff.

END OF SECTION 260530

SECTION 260537 – SLEEVES AND PENETRATIONS

PART 1 - GENERAL

1.1 SCOPE:

A. Provide sleeves, seals and openings for cables penetrating walls, interior masonry walls and partitions, floors, and roofs as specified here.

B. All sleeves, seals and openings required shall be located and provided by this Contractor for his portion of the work.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 260545 - Fire Seals.

B. Section 260530 - Conduit.

PART 2 - PRODUCTS

2.1 CONDUIT SLEEVES, SEALS AND ESCUTCHEONS:

A. Provide sleeves for each cable passing through walls, partitions, floors, and roofs.

B. Provide conduit sleeve system for roof penetrations, as specified here. In addition, provide sleeves for some conduit applications, as specified here.

C. Sleeve Material:

Type	Designation
1	18 gauge, adjustable or fixed length, galvanized steel, Pipe Shields Inc. or equal.
2	Standard weight galvanized steel pipe or conduit.
3	Standard weight galvanized steel pipe or conduit with a continuous welded stop of ¼" steel plate extending outside of sleeve a minimum all around, like R&S Manufacturing Corp. Fig. 204.
4	Cast iron pipe sleeve with center flange, like James B. Clow and Sons No. F-1430 and F-1435.

D. Sleeve Sizes:

1. Sleeves for conduit shall be adequate size to accommodate a minimum of ½" clearance between inside of sleeve and outside of pipe.

E. Sleeve Lengths:

Location	Sleeve Length
Floors	Equal to depth of floor construction including finish. In waterproof floor construction sleeves to extend minimum of 2" above finished floor level.
Walls and Partitions	Equal to thickness of construction and terminated with surfaces.

F. Sleeve Caulking and Packing:

Type	Designation	Caulking and Packing Requirements
1.	A	Space between metallic conduit and sleeve to be provided with waterproofing seal method as specified under Section 260530.
2.	B	Space between metallic conduit and sleeve shall be caulked with a fire-resistant foam sealant, per Section 260545.
3.	C	Space between conduit covering and sleeve shall be packed with mineral wool and sealed tight with caulking.
4.	D	No sleeve required for metallic conduit penetration. Space between conduit and wall shall be sealed tight with caulking.

G. Sleeve Application:

Sleeve Type	Location	Sleeve Caulking & Packing Type Designation
1	Interior fire rated walls, partitions and floors	B
	Interior non-fire rated stud walls and partitions	D
	Interior non-fire rate masonry walls and partitions	C
2	Membrane, waterproof floor and wall construction	B

Note: Another trade will install membrane up around sleeve and inside sleeve.

3 or 4	Exterior walls	A

H. Escutcheons:

1. Provide escutcheons on all exposed conduit passing through walls, floors, partitions, and ceilings.
2. Escutcheons shall be held in place by internal spring tension or set screws.

I. Application:

Location	Escutcheon Material
Finished spaces	Anodized aluminum, chrome-plated brass
Unfinished spaces, excluding mechanical equipment rooms	Plain brass, galvanized steel, cast iron or aluminum

2.2 PENETRATIONS THROUGH ROOF:

A. Pipe curbs for raceway and piping passing through roof shall consist of a roof curb, curb covers, and resilient caps with stainless steel clamp sized for passing pipe. Curb covers shall be not less than 12 inches square and where multiple covers are required; galvanized steel troughs shall be provided between covers to provide a watertight assembly. Covers shall be fabricated of ABS plastic with pre-punched mounting holes and a laminated acrylic coating. Sealing caps shall be EPDM compression molded rubber, with openings sized for passing pipe or piping and with stainless steel clamps.

B. When feasible, penetrations through roof may be combined in a single pipe curb with piping provided under other trades.

C. Required penetrations through roof for connections to roof top equipment and exhaust fans, shall be through the designated area within the roof top unit, or within roof curb provided with the equipment whenever feasible, as directed by HVAC subcontractor.

PART 3 - EXECUTION

3.1 PLACEMENT OF SLEEVES:

A. Sleeves shall be furnished and placed, and openings located as construction proceeds and in ample time to avoid delay to the work. After construction of wall or floor has been accomplished remove the sleeve and proceed to install raceway or pipe, except that sleeve through floors with membrane waterproofing, fire rated gypsum or plaster drywalls and smoke partitions, shall remain in place properly secured to the slabs or wall.

B. Where sleeves or grouped raceway and pipe are to be installed in openings concurrent with or after construction, such items shall be securely fastened in place and the opening filled and patched with material approved for the construction.

C. Sleeves and openings shall be protected during all phases of construction. Care shall be taken to prevent concrete, plaster, or other construction material from closing the sleeve.

D. Submit to the Architect/Engineer for approval plan of proposed sleeve locations and sites prior to performing any sleeve works.

END OF SECTION 260537

SECTION 260541 – BOXES AND ENCLOSURES

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Work under this Section includes but is not necessarily limited to the following:
   1. Outlet Boxes, including floor outlets
   2. Cabinets and Enclosures
   3. Access Doors

1.2 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. Equipment specified in this Section shall meet the following specifications and standards.
   1. UL Standards:
      a. Electric Cabinet and Boxes
      b. Outlet Boxes and Fittings
   2. NEMA Standards:
      a. Boxes, OS1

1.3 QUALITY ASSURANCE:

A. The manufacturer shall review the use, details, and methods of installation of his product as indicated and shall disclose to the Architect all deviations from his recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

1.4 SUBMITTALS:

A. Submit manufacturer's catalog data on all products specified here.

PART 2 - PRODUCTS

2.1 OUTLET BOXES, PULL BOXES, CABINETS AND ENCLOSURES:

A. Boxes:
   1. Unless otherwise specifically noted, all boxes shall be of the metallic type.
   2. Boxes shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of NEC, Article 314. Outlet boxes that are exposed to the weather or that are in normally wet locations shall be of the cast-metal type

having threaded hubs. Boxes shall be of suitable construction for installation in the environment of their location.

3. Zinc-coated or cadmium-plated sheet steel boxes, or a class to satisfy the conditions of each outlet, shall be used in concealed work or in exposed work above eight feet from floor.
4. Fixture outlet boxes on ceiling shall be not less than 4 inch octagonal. Fixture outlet boxes in concrete ceiling shall be of the 4-inch octagonal concrete type, set flush with the finished surface. Fixture outlet boxes on plastered ceilings shall be fitted with open covers set to come flush with the finished surface.
5. Switch, communication, data, and receptacle outlet boxes in dry walls, plastered walls and pour-in concrete walls shall be not less than 4 inches square cut with appropriate extension to set flush with the finished surface. One-piece gang or gang able boxes not less than 2 inches deep shall be utilized where the use of 4-inch square boxes is not feasible. Telecommunication and data wiring outlet boxes, other than those in floors, shall have one GANG extension ring to fit outlet plate. Coordinate with Telecommunications Contractor.
6. Unless otherwise noted on the drawings, outlet, junction or pull boxes not larger than 5 inches square and within eight feet from floor level in exposed work shall be of cast steel or alloy with threaded hubs and appropriate covers.
7. Outlet boxes in un-plastered masonry and gypsum drywall walls shall be tile type.
8. Outlet boxes for use with power systems shall be not less than 1½ inches deep, except as otherwise noted above and for telecommunication outlets.
9. Outlet box for use with telephone and data (telecommunications) systems shall be not less than 2-3/8 inches deep.
10. A device plate or cover shall be provided for each outlet to suit the outlet. Refer to Section 262727 for wiring device plates.

B. Pull Boxes:

1. Pull boxes shall be constructed of code-gauge galvanized sheet metal. Boxes shall be of not less than the minimum size required by the National Electrical Code and shall be furnished with screw fastened covers. When several feeders pass through a common pull box, they shall be tagged to clearly indicate their electrical characteristics, circuit numbers and panel designations. Pull box cover plates larger than four square feet shall be provided with two handles.
2. Pull boxes shall be furnished and installed where necessary, as approved by the A/E, in the raceway system to facilitate conductor installation. Except as otherwise noted for telephone and data raceways, conduit runs longer than 200 feet, or with more than three 90-degree angle bends, shall have a pull box installed at a convenient intermediate location to limit bends to not more than 180 degrees in any pull. Normally, when feeder routing is shown on drawings, pull boxes are not indicated. It is the responsibility of the electrical contractor to provide pull boxes as necessary to meet the stated requirements.

C. Cabinets:

1. Cabinet boxes shall be constructed of zinc-coated sheet steel and shall conform with the requirements of Underwriters' Laboratories "Standards for Cabinets and Cutout Boxes". Unless otherwise noted, cabinet trims shall have a corrosion inhibiting primer and a lacquer finish. Cabinets shall be of suitable construction for installation in the environment of their locations.

2.2 QUALITY ASSURANCE:

A. It is the responsibility of Division 26 subcontractor to assure that the device brackets and plates intended for telecommunication devices are compatible and suitable for the telecommunication devices specified under Division 27.

2.3 ACCESS DOORS IN FINISHED CONSTRUCTION:

A. Provide flush doors to access electrical boxes as specified and as permitted by Architect only.

B. Avoid access doors to maximum extent feasible by setting circuits so that boxes are above accessible ceilings.

C. Study architectural and electrical construction documents for areas with non-accessible finishes.

D. Where boxes and devices are to be concealed in walls or above non-removable ceilings, each Contractor shall provide the required access panels at no extra cost to the Owner.

E. Submit drawings to the Architect/Engineer showing location of proposed access doors prior to installation of any wiring. Architect/Engineer shall have the right to modify or delete location of access doors proposed by the electrical contractor without adding cost to the electrical contract.

F. Size of panels shall be larger than the devices for accessibility and shall not be less than 16”x 16” for all panels. Where the opening must allow adequate room for a person to pass through, a 24”x 24” panel shall be provided.

G. Construction of panels shall comply with the following:
   1. Fire Rating: Access doors shall be constructed and installed in a manner that does not violate fire rating of ceiling or wall.
   2. Regular Access Doors in Concrete or Masonry Walls: Shall be prime coated steel to the sizes and at the locations indicated. Locks shall be screwdriver operated.
   3. Standard Thickness Plastered Walls: Shall be J.L. Industries Model PW, Karp Associates, Inc. Type DSC-214 PL, Milcor, Inc. Style "A", or approved equal.
   4. Non-plastered walls: Shall be J.L. Industries Model TM, Karp Associated, Inc., Type DSB-214SM, Milcor Style "M", or approved equal.
   5. Thin coat plastered walls: shall be J.L. Industries Model PW modified, Karp Associates, Inc. Type DSB-214 SM, Milcor style "DW" or approved equal.
   6. Rated Access Doors in Concrete or Masonry Walls shall be prime coated steel to the sizes and at the locations indicated. Locks shall be key operated. Fire rating shall be for 1-1/2 hours in accordance with UL. Doors shall incorporate any modifications required to receive the wall finish. Shall be J.L. Industries Model FD, Karp Associates, Inc. Type KRP-150 FR, Milcor fire rated access door, or approved equal.
   7. Regular Access Door in Plastered Ceiling: Shall have expanded mesh plastering lath on all 4 sides with method for securing to ceiling suspension system. Shall be Model PW by J.L. Industries, DSC-214PL by Karp Associates, Inc., Style "K" by Milcor, or approved equal. Shall have screwdriver operated lock.

2.4 1½ HOUR RATED ACCESS DOOR IN DRYWALL CEILING:

A. Shall have expanded mesh plastering lath on all 4 sides with method for securing to ceiling suspension system. Shall be Model FD by JL Industries, KPP-150 FR (modified) by Karp Associates, Inc., fire rated access door by Milcor, or approved equal. Shall have screwdriver operated lock.

B. Regular Access Door in Plastered Stud Wall: Size shall be 24” x 24” and shall have expanded mesh plastering lath on all 4 sides with method for securing to studs. Shall be Model PW by J.L. Industries, DSC-214PL by Karp Associates, Inc., Style "K" by Milcor, or approved equal. Shall have screwdriver operated lock.

C. 1½ Hour Rated Access Door in Plastered Stud Wall: Shall have expanded mesh plastering lath on all 4 sides with method for securing to studs. Shall be Model PW by JL Industries, DSC-214PL by Karp Associates, Inc., Style "K" by Milcor, or approved equal. Shall have screwdriver operated lock.

D. 1½ Hour Rated Access Door in Plastered Stud Wall: Shall have method for securing to ceiling suspension system. Shall be Model WB by J.L. Industries DSB-2145M by Karp Associates, Inc. Style "DW" by Milcor, or approved equal. Shall have screwdriver operated lock.

E. Regular Access Door in Drywall Ceiling: Shall have method for securing to ceiling suspension system. Shall be Model WB by J.L. Industries, DSB-2145M by Karp Associates, Inc., Style "DW" by Milcor, or approved equal. Shall have screwdriver operated lock.

F. 1½ Hour Rated Access Door in Drywall Ceiling: size shall be 24” x 24” and shall have method for securing to ceiling suspension system. Shall be Model FD by J.L. Industries, KRP-150FR (modified) by Karp Associates, Inc., fire rated access door by Milcor, or approved equal. Shall have screwdriver operated lock.

G. Regular Access in Drywall Stud Wall: Shall have method for securing to studs. Shall be Model WB by J.L. Industries, DSB-214SM by Karp Associates, Inc., Style "DW" by Milcor, or approved equal. Shall have screwdriver operated lock.

H. 1½ Hour Rated Access Door In Drywall Stud Wall: Shall have method for securing to studs. Shall be Model FD by J.L. Industries, KRP-150FR by Karp Associates, Inc. fire rated access door by Milcor, or approved equal. Shall have screwdriver operated lock.

PART 3 - EXECUTION

3.1 FIRE RATING:

A. Boxes shall not be permitted to be installed in walls, slabs, or in decks if installation violates or reduces fire rating of such wall, slab, or deck, unless additional fire proofing is provided to maintain fire rating.

3.2 INSTALLATION OF OUTLETS:

A. Location of outlets shown on drawings, other than those dimensioned, are only approximate, the Owner shall have the right to make slight changes in the position of outlets if the Contractor is notified before roughing-in is done. The Contractor shall study the general building plans in relation to the spaces surrounding each outlet in order that his work may fit the other work required by these specifications. When necessary, the Contractor shall relocate outlets of junction boxes so that, when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment. Do not install outlets back-to-back.

B. Coordinate with telecommunications contractor for location of outlets provided under Division 16 for use by telecommunications contractor. Refer to Section 260100 for additional requirements.

C. Minimum length of conduit connecting to adjacent flush in wall outlets in sound rated walls shall be 18", or walls with sound attenuation materials.

D. Boxes shall be installed in a rigid and satisfactory manner, either by wood screws on wood, expansion shields on masonry, or machine screws on steel work.

E. Recessed boxes in dry wall type construction shall be supported from both adjacent studs or using metal stud brackets as manufactured by E-Z Mount Bracket Co., or equivalent.

3.3 INSTALLATION OF PULLBOXES:

A. Pull boxes shall be installed overhead or on walls at locations free of interference with equipment, ducts, piping, and activities being carried out at the premises.

3.4 BOXES AND CABINETS IN FIRE RATED WALLS AND FLOORS:

A. Outlet boxes in one and two-hour fire rated walls shall be installed in conformance with approved UL methods. UL listed steel electrical outlets, switches, or junction boxes not exceeding 16 square inches in area and 2-3/16” in depth, in hollow walls or partition assemblies utilizing wood or metal studs or metal framing or channels are permitted, provided such outlet boxes do not exceed an average of 100 square inches per 100 square feet of wall and are staggered not less than 24 inches side-to-side horizontally when openings are provided on either side of the wall.

B. When location or dimension of outlet boxes does not meet the requirements listed above, protect each outlet utilizing gypsum board sheathing or fire proofing blankets in accordance with UL approved methods if acceptable to the local code authority. One product approved to protect outlets is 3M Company moldable Putty Pads, Catalogue Number MPP-1. Fire proofing material must be independently supported of the box or cabinet being protected.

C. Provide gypsum board covering on all five sides of cabinets mounted in one- or two-hour fire rated walls to maintain rating of wall.

D. Provide additional fir proofing on underside of fire-rated slabs where floor boxes are installed. Use, as best suited to the project and as approved by the A/E and fire marshal, additional spray-on insulation of layers of gypsum board to maintain floor fire rating.

E. Do not install outlet boxes or cabinets in 4-hour rated walls.

3.5 OUTLET IDENTIFICATION:

A. All outlet boxes, junction boxes and pull boxes in equipment rooms and above accessible ceilings shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers on boxes above lift-out and other type accessible ceilings.

END OF SECTION 260541

SECTION 260543 – UNDERGROUND SITE RACEWAY AND DUCTBANK SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section applies to conduit systems for power company primary cables, secondary service conduit systems, telecommunication service conduits, lightning protection system conduits, fire alarm system conduits, ground ring, conduits for circuits that are to connect to emergency generator set and conduits for other miscellaneous exterior power and low voltage connections.

B. Provide underground site raceway and duct systems, as shown on the drawings and specified here, including but not limited to the following systems:
   1. Power Distribution System
   2. Telecommunications Site Distribution System
   3. Lightning Protection
   4. Grounding

1.2 WORK INCLUDED

A. The raceway and duct systems shall be complete, including, but not necessarily limited to, raceways, ducts, handholes, pull boxes, pull cords and grounding provisions.

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS

A. Work, as applicable, shall conform to the latest issue of the following standards:

   1. NEMA Standards
      a. TC-2 Electric Plastic Tubing (EPT) and Conduit (EPC-40 & EPC-80)
      b. TC-3 PVC Fittings
      c. TC-6 PVC Plastic Utilities Duct for Underground Installations
   2. American Society for Testing and Materials
      a. ASTM A 48 - Gray Iron Castings
      b. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      c. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      d. ASTM B 117-18 - Operating Salt Spray (Fog) Apparatus
      e. ASTM C 478-18 - Circular Precast Reinforced Concrete Manhole Sections
   3. American Concrete Institute
      a. ACI-318 - Building Code Requirements for Reinforced Concrete

1.4 SUBMITTALS

A. Submit proposed location of new duct banks indicating new and existing pipes and conduits crossing proposed duct bank routing. Relocation of duct banks up to 20 feet in any direction from location shown on drawings shall be done at no extra cost to Owner.

B. Submit catalogue information of ducts being proposed for installation with description of intended use.

C. Submit complete pre-engineered precast handholes shop drawings with a copy of professional engineer's seal.

D. Submit record drawing at the end of project with dimensioned locations of each handhole and each underground duct bank and conduit.

PART 2 - PRODUCTS

2.1 UNDERGROUND DUCT BANK SYSTEM

A. System shall consist of single, round bore conduits encased in concrete. The minimum number and size of ducts shall be as indicated on the drawings.

B. Concrete: Provide not less than 3 inches of concrete around each duct. Concrete shall be plain except where reinforced concrete is specified herein or indicated on the drawings. Plain and reinforced concrete shall conform to Division 03 - Concrete of these specifications and shall be 2000 PSI Class, or higher rating, except as otherwise required by Power Company. All other concrete, like for concrete pads, shall be rated 3000 PSI. Duct lines shall be of monolithic construction. Where a connection is made to an existing duct line, the concrete encasement shall be well bonded to the existing encasement.

C. Plastic Duct: Duct for underground duct systems shall be UL listed, Schedule 40, rigid plastic conduit suitable for encasement in concrete.

D. Duct for power circuits shall be not less than 75 percent polyvinyl chloride, Schedule 40, suitable for power service with 90 degrees C. conductors and conforming heavy wall rigid to NEMA standards, suitable for direct burial or encasement in concrete.

E. Duct for communication and alarm systems shall be not less than 75 percent polyvinyl chloride, heavy wall rigid Schedule 80, suitable for the class of conductors used and conforming to NEMA standards, suitable for direct burial or encasement in concrete.

F. Conduit Sealing Compound: Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 2 degrees C (35 degrees F), shall neither slump at a temperature of 150 degrees C (300 degrees F), nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

G. Pull Cords: All new spare ducts or conduits shall be provided with nylon pull cords.

H. Tracer Cable: Provide a #8 AWG bare copper cable embedded in each telecommunication duct bank, approximately 3 inches from top of duct bank to facilitate future finding of duct banks.

2.2 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Color: Gray.

B. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

C. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

D. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

E. Cover Legend: Molded lettering, "ELECTRIC" or "TELEPHONE" as indicated for each location.

F. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

G. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

H. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.3 HANDHOLES

A. Handholes shall be constructed approximately where shown on drawings. The exact location of the handhole shall be determined after careful consideration has been given to the location of other utilities, grading and paving. The location of the handhole shall be approved before construction of the handhole is commenced. A cable pulling iron shall be installed in the wall opposite each duct line entrance into handhole. Where duct lines enter handholes, the sections of duct may be either cast in the concrete or enter the handhole through a square or rectangular opening of suitable dimensions provided in the handhole walls. Where openings are provided for the entrance of duct lines, the space between ducts and between ducts and handhole walls shall be caulked tight with lead wool or equivalent sealer. Handhole covers shall be the type shown on drawings, complying with ASTM A48, Class 30B, minimum, and shall be embossed 'electric' or 'telephone' as applicable. In paved areas, frame and covers in vehicular traffic areas shall be rated for wheel loads in accordance with ES RR-F-621. Precast-concrete handholes shall have the required strength established by ASTM C478. Equivalent pre-engineered precast handholes in lieu of poured in place type are acceptable.

PART 3 - EXECUTION:

3.1 GENERAL:

A. Prior to starting any work, perform non-obtrusive survey of proposed route for new duct banks and identify existing underground utility lines.

B. Coordinate closely with all trades performing work on the site prior to starting any work to identify all utility locations and to maintain required clearances.

C. Coordinate closely with all trades performing work on the site prior to starting any work related to trenching to clearly define the division of work.

D. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet. Changes in direction of runs exceeding 10 degrees shall be accomplished by using special couplings or bends manufactured for this purpose. Duct lines for wiring below 600 volts shall be installed so that the top of concrete or future concrete as shown, is not less than 24" below finished grade or finished paving at any point. For communications wiring, minimum cover shall be 24". For duct banks containing circuit with voltage above 600 volts, the minimum cover shall be 30". Where duct lines enter handholes or pull boxes, the conduits shall terminate in end bells. Conduit shall be thoroughly cleaned before laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent washing mud into the conduits. Care shall be taken to keep the conduits clean of concrete or any other substance during construction. Where it is necessary to cut a tapered end on a piece of conduit at the site, the cut shall be made with a tool or lathe designed to cut a taper to match the taper of the conduit to be used. After the duct line has been completed, a mandrel not less than 12 inches long, having a cross section approximately one-fourth inch less than the inside cross section of the conduit shall be pulled through each conduit, after which a brush with stiff bristles shall be pulled through to make certain that no particles of earth, sand or gravel have

been left in the lines. After this is accomplished, provide waterproof, 130-pound tensile test strength, pull marking cord (marked at least every foot), and equivalent to Greenlee No. 435 in all ducts, including spares. Except where a particular type is indicated on the drawings, the conduit furnished shall be concrete encased plastic.

E. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.

3.2 INSTALLATION OF DUCT BANKS COMPRISING MULTIPLE CONDUITS:

A. Each single conduit shall be completely encased in concrete with a minimum of 3 inches between conduits and a minimum thickness of concrete encasement of 3 inches all around, which may be increased to fit the actual shape of the trench. Joints in conduits shall be staggered at least 6 inches. Spacing blocks shall be made of concrete or other suitable non-metallic, non-decaying material. Ducts shall be securely anchored to prevent movement during the placement of concrete.

B. Concrete encased nonmetallic ducts shall be supported on plastic separators coordinated with duct size and spacing. Separators shall be spaced close enough to prevent sagging and deforming of ducts. Separators to the earth and to ducts should be secured to prevent floating during placement of concrete. Steel or tie wires should not be used in such a way as to form conductive or magnetic loops around ducts or duct groups.

C. The arrangement of conduit in duct bank shall be in accordance with OSHA requirements.

3.3 INSTALLATION OF SINGLE CONDUIT:

A. Shall be completely encased in concrete. The thickness of concrete shall be not less than 3 inches on the sides, bottom, and top of the conduit.

3.4 TRENCHING AND BACKFILLING:

A. The contractor shall furnish all plant, labor, equipment, appliances, and materials, and perform all operations in connection with the trenching and backfilling for electrical conduit systems. The contractor shall perform all excavation of every description and of whatever substances encountered, to the depths specified or indicated on the contract drawings. All excavated materials not required for fill or backfill shall be removed and wasted as directed. All excavations shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required shall be properly sheeted and braced.

3.5 DUCT BANK MARKING:

A. Make the following provisions to identify duct bank locations:

1. Lay a yellow underground plastic line marker 6 to 8 inches below finished grade, directly above the concrete bank in the backfill. The yellow plastic marker should be not less than 6 inches wide and 4 mils thick for the full length of the concrete and should have two lines of continuous markings which read:

a. "CAUTION, CAUTION, CAUTION - BURIED ELECTRIC (OR TELECOM, AS APPLICABLE) LINE BELOW"

2. In addition to the above provide a copper locator cable with telecommunications duct banks to facilitate location in future.
3. In addition to the above, the top of the concrete duct bank shall be covered with red dye.

B. Submit with record drawings the exact location of duct banks and handholes using actual field dimensions referenced to the building.

3.6 DUCT TRENCH EXCAVATION:

A. The bottom of duct trenches shall be accurately graded to provide uniform grade of 4 inches per 100 feet minimum. Any over depth excavation shall be filled with sand, gravel, or concrete, at the expense of the contractor. The depth of the duct trench shall be determined by the finished grade and the minimum depth of the duct bank and obstructions.

3.7 GRADING AND STACKING:

A. All grading in the vicinity of trench excavations shall be controlled to prevent surface ground water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods. During excavation, material suitable for backfilling shall be stacked in an orderly manner, a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted as directed.

3.8 SHORING AND SHEETING:

A. All shoring and sheeting required to perform and protect the excavation and to safeguard employees shall be performed in accordance with the published standards of the N.C. Department of Labor.

B. The trenches shall be carefully backfilled with excavated materials approved for backfilling that are free from large clods of earth or stone. Blasted rock, broken concrete or pavement and large boulders shall not be used as backfill material. Settling the backfill with water will be permissible or required when so directed. Any trenches improperly backfilled or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and compaction, mounded over, and smoothed off. Backfill in open areas shall be compacted to at least 95 percent of maximum density. Backfill under paved areas shall be compacted to at least 95 percent of maximum density with the top layer of at least 6 inches compacted to at least 97 percent of maximum density at, or near, optimum moisture, as determined by the AASHO T-180 Method D.

3.9 PROTECTION OF EXISTING FACILITIES:

A. Streets and Walks: Streets connecting to the project shall be protected from deposits of mud, sand, stone, litter or debris in any form, and this protection shall be the responsibility of the Contractor. All mud collected on vehicle wheels must be cleaned off before leaving the

construction area. Should any mud or debris collect on the streets from the construction project, this shall be removed immediately before becoming a traffic hazard or being carried into the surrounding buildings.

B. Street Patching: Where Street paving is cut for placing new utility lines, the asphalt shall be neatly cut and removed with an asphalt cutter. Breaking the asphalt out with a backhoe or other means will not be acceptable. Boards or other suitable material shall be placed under backhoe outrigging to prevent damage to the asphalt. The patching shall consist of a minimum of six inches of run-of-crusher stone and two inches of asphalt, regardless of the existing conditions. If the surrounding pavement is damaged by backhoe or by any other means, the damaged spot shall be cut out and patched as above. The asphalt that has been cut shall be replaced to match the original conditions within 48 hours of cutting it.

C. Stone base and paving shall be placed immediately after opening in street is backfilled. Backfill shall be tamped thoroughly, and any minor settlement which occurs in the street during the twelve (12) month warranty period shall be repaired by resurfacing the patch with asphalt at no further cost to the Owner.

D. Walk Patching: Asphalt sidewalks shall be patched as specified for streets except use 2 inches of stone base and 1 ½ inches of asphalt. Brick and concrete sidewalk patching shall be of a quality equal to the existing. Patches must be cut out neatly to all score mark boundaries or to squared areas. Irregular or splotchy patching is not acceptable.

E. Drainage Systems: All catch basins and storm drain lines in the vicinity of the site shall be always protected from entry of mortar, concrete spoil, or other construction debris. The residue from the cleaning of ready-mix trucks, wheelbarrows, concrete buggies, etc. must be prevented from entering the drainage systems, and if cleaning is done, it must be contained from the residue removed from the campus with other refuse.

F. Trees and Shrubs:

1. Trees and shrubs to be retained within the limits of construction site shall be protected by a 48-inch chain link fence to be installed around the outer perimeter of the spread of the branches.
2. Care shall be taken to protect trees from damage by cranes, falling objects, etc. Trees and shrubs shall not be pruned or moved by the contractor. When pruning or moving is necessary, the A/E shall be notified and the work will, in turn, be performed by the Owner at no cost to the contractor.
3. Trees outside the construction limits shall be protected from:
    a. Compaction of root areas by equipment, materials, or fill dirt.
    b. Truck damage by moving equipment, material storage, mauling or bolting.
    c. Poisoning by pouring solvents, gas, paint, etc. on or around roots.
    d. Unnecessary cutting of roots.
    e. Damage of branches by improper equipment activity.
    f. Cutting of roots within the drop line of the tree.
4. Underground structures and utilities shall be designed in such a way that installation will not damage or destroy trees and shrubs which have been designated to remain. All such work shall be closely coordinated during construction to prevent damage or destruction to trees and shrubs.
5. Damaged shrubs or trees shall be repaired by a nurseryman or tree surgeon in a manner acceptable to the Owner, and the cost of repairs shall be paid for by the contractor.

G. Pedestrian Traffic around the construction limits must always be maintained in a clean and safe condition. When excavation outside of the project limits is required, the contractors shall return the area to its original condition immediately following the excavation work. This is to provide a safe walking surface but prevents excessive dirt from being tracked into adjacent buildings.

3.10 WATERPROOFING:

A. All conduits that originate outside of building perimeter and terminate inside building, shall be waterproofed both inside the conduit and around conduit.

END OF SECTION 260543

SECTION 260545 – FIRE SEALS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Work includes furnishing and installing fire and smoke barrier penetration seals for openings in floors, walls, and other elements of construction.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 260537 - Sleeves and Penetrations

1.3 QUALITY ASSURANCE:

A. Applicator Qualifications: Two years experience installing UL Classified fire stopping materials.

B. Performance: Materials shall have been tested to provide fire rating equal to that of the construction.

1.4 SUBMITTALS:

A. Shop Drawings:
1. Submit shop drawings showing each condition requiring penetration seals indicating proposed UL systems materials, anchorage, methods of installation and actual adjacent construction.
2. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications.

B. Manufacturer's Data: Submit copies of manufacturer's specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.

C. Applicators Qualifications Statement: List past projects indicating required experience.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, grade and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store materials in clean, dry, ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instructions.

1.6 ENVIRONMENTAL REQUIREMENTS:

A. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

1.7 GUARANTEE:

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following manufacturers as further defined in the Systems and Applications Schedule in Part 3 of this Section.
   1. 3M Company
   2. US Gypsum - Thermafiber Insulation
   3. Vimasco Corporation, Nitro-West Virginia
   4. Nelson
   5. or Approved Equal.

2.2 SEALING OF PENETRATIONS THROUGH NON-RATED WALLS AND FLOORS:

A. In addition to the fire proofing of fire rated walls and floors as specified here, penetrations of non-rated walls, partitions and floors of noncombustible construction shall also be sealed with noncombustible materials, suitable for the environment of the penetrations.

2.3 MATERIALS:

A. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated.

B. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fittings, adhesion, or the required fire resistance.

B. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction. Seal holes or voids made by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damage on surfaces subject to traffic.

3.2 FIELD QUALITY CONTROL:

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

3.3 ADJUSTING AND CLEANING:

A. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials and debris leaving area in undamaged, clean condition.

3.4 SYSTEMS AND APPLICATION SCHEDULE:

A. Refer to complete set of Contract Drawings for rated assemblies.

3.5 INTERIOR OF SLEEVES:

A. Space inside sleeve, whether occupied by cables or not, shall be plugged with UL classified fire stopping material suitable for the specific application.

END OF SECTION 260545

SECTION 260553 – NAMEPLATES AND SIGNS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Related work specified elsewhere:
   1. Section 260574 – Overcurrent Protective Device Coordination Study

B. Furnish and install under Division 26 – Electrical, engraved laminated phenolic nameplates for all safety switches, panelboards, individually mounted circuit breakers – including motor controllers furnished under Divisions 21, 22 or 23, fire alarm control equipment and other electrical equipment supplied for the project. Embossed, self-adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:
   1. Blue surface with white core for 120/208-volt equipment.
   2. Bright red surface with white core for all equipment related to fire alarm system.
   3. Dark red (burgundy) surface with white core for all equipment related to security.
   4. Orange surface with white core for all equipment related to telephone systems.
   5. Brown surface with white core for all equipment related to data systems.
   6. Black surface with white core for grounding terminations.

C. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.

D. All outlet boxes other than those containing wiring devices, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers on boxes above lift-out and other type accessible ceilings.

E. Provide nameplates at each panelboard and at each termination, connection, and splice point, in accordance with requirements of NEC 210.5(c) showing the color scheme used to identify the phase, neutral and grounding conductors of each voltage system in the premises. The color coding for the conductors shall be as described in Section 260519.

1.2 NAMEPLATE INFORMATION:

A. Nameplate for panelboards and distribution switchboards shall indicate their designation plus circuit designation of panelboard feeder plus voltage. For example: “Panel 1LAC - Served from SBA-15, 208/120 volts.”

B. Nameplates for individual circuit breakers shall indicate equipment served, circuit breaker frame and size in amperes of the breaker trip, plus circuit designation of power source.

C. Nameplates for individually mounted safety switches shall indicate designation of equipment served, size in ampere of fuses, type of fuses, plus circuit designation of power source. For example, “Pump P-5 circuit 2MCB-A6”.

D. Nameplates for troughs or wireways shall indicate given designation, voltage, phases, and number of wires plus circuit designation of trough feeder.

E. Equipment likely to be energized from two different sources at the same time shall be provided with warning nameplates clearly stating this condition.

F. Bypass switches or circuit breakers likely to be energized from the load side when the device is in the “off” position shall be provided with warning nameplates clearly indicating this possibility.

G. Provide sequence of operation of same construction as nameplates for equipment provided with bypass devices for manual transfer of loads. The sign describing the necessary steps for the transfer of loads shall be provided on the front of equipment, in a prominent location not over 68” above floor. In cases where the bypass equipment is at different location provide sequence of operation signs at each location.

H. Pushbuttons, control, and selector switches, and indicating lights in remote control stations shall be identified with engraved laminated plastic name plates affixed to front cover in a suitable location. The nameplate shall carry the identification of the system which is being controlled.

I. Each receptacle and light switch areas shall be provided with nameplate identifying circuit feeding receptacle. (For Example: “422P-16”).

J. Cables terminating on telecom ground bars, power ground bars and on main power ground bar shall be provided with phenolic nameplate identifying the purpose/destination of the cable. Nameplates shall be 3 inches by 1 inch with ¼ inch lettering and shall be affixed to the cable utilizing ty-wrap nylon bands.

PART 2 - PRODUCTS

2.1 CONSTRUCTION:

A. Nameplates shall be 1/8 inch thick of phenolic material with all four face edges beveled 45 degrees, except that nameplates for wiring devices may be 1/16 inch thick of same type construction. Lettering shall be machine engraved to expose contrasting inner core color.

B. Equipment nameplates shall include ½-inch high lettering, approximately.

C. Lettering for sequence of operation signs, wiring devices and other lengthy explanatory signs, shall be not less than 1/8 inch high.

PART 3 - EXECUTION

3.1 GENERAL:

A. Affix nameplates to plates or equipment utilizing self-tapping stainless-steel screws.

END OF SECTION 260553

SECTION 260574 – OVERCURRENT PROTECTIVE DEVICE COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Specification Section 260100 – General Provisions – Electrical, Drawings, and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies and arc fault hazard identification and marking. Protective devices shall be set based on results of the protective device coordination study.

B. Coordination of series-rated devices is not permitted.

C. A professional engineer, licensed by the state of North Carolina, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

D. Comply with IEEE 242 - 2001 Recommended Practice for Protection and Coordination of Industrial and Commercial Power System Analysis for short-circuit currents and coordination time intervals.

E. Comply with IEEE 399-1997 Recommended Practice for Industrial and Commercial Power System Analysis for general study procedures.

F. The electrical gear shown on this project may not be coordinated with the devices of certain manufacturers. The contractor shall be responsible for any changes in feeder space or type of circuit breakers required. Coordinate the system selectively.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.
   1. Coordination-study input data, including completed computer program input data sheets.
   2. Study and Equipment Evaluation Reports.
   3. Coordination-Study Report.
   4. Arc fault values.
   5. Arc fault documentation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For coordination-study specialist.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399 and IEEE 242.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

C. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

D. Comply with IEEE 242 - 2001 Recommended Practice for Protection and Coordination of Industrial and Commercial Power System Analysis for short-circuit currents and coordination time intervals.

E. Comply with IEEE 399-1997 Recommended Practice for Industrial and Commercial Power System Analysis for general study procedures.

F. The electrical gear shown on this project may not be coordinated with the devices of certain manufacturers. The contractor shall be responsible for any changes in feeder space or type of circuit breakers required. Coordinate the system selectively.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:
   1. CGI CYME.
   2. EDSA Micro Corporation.
   3. ESA Inc.
   4. Operation Technology, Inc.
   5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

B. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

C. Optional Features required:
1. Arcing faults.
2. Simultaneous faults.
3. Explicit negative sequence.
4. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

B. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

B. Product Data for overcurrent protective devices specified in other electrical Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

C. Impedance of utility service entrance.

D. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
1. Circuit-breaker and fuse-current ratings and types.
2. Relays and associated power and current transformer ratings and ratios.
3. Generator kilovolt amperes, size, voltage, and source impedance.
4. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.

5. Motor horsepower and code letter designation according to NEMA MG 1.
6. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    c. Generator thermal-damage curve.
    d. Ratings, types, and settings of utility company's overcurrent protective devices.
    e. Special overcurrent protective device settings or types stipulated by utility company.
    f. Time-current-characteristic curves of devices indicated to be coordinated.
    g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    i. Panelboards and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
    1. Distribution panelboard.
    2. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties based on maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, IEEE 241, and IEEE 242, as applicable.

E. Transformers:
    1. ANSI C57.12.10.
    2. ANSI C57.12.22.
    3. ANSI C57.12.40.
    4. IEEE C57.12.00.
    5. IEEE C57.96.

F. Medium-Voltage Circuit Breakers: IEEE C37.010, as applicable.

G. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.

H. Low-Voltage Fuses: IEEE C37.46.

I. Study Report:
   1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
   2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium- and high-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

J. Equipment Evaluation Report:
   1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
   2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
   3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

B. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

C. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.

D. Calculate the maximum and minimum ground-fault currents.

E. Comply with IEEE 141, IEEE 241 and IEEE 242 recommendations for fault currents and time intervals, as applicable.

F. Transformer Primary Overcurrent Protective Devices:
   1. Device shall not operate in response to the following:
   2. Inrush current when first energized.
   3. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
   4. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
   5. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

G. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

H. Conductor Protection:
   1. Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage

insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. Coordination-Study Report:
   1. Prepare a written report indicating the following results of coordination study:
   2. Tabular Format of Settings Selected for Overcurrent Protective Devices:
   3. Device tag.
   4. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
   5. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
   6. Fuse-current rating and type.
   7. Ground-fault relay-pickup and time-delay settings.

J. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
   1. Device tag.
   2. Voltage and current ratio for curves.
   3. Three-phase and single-phase damage points for each transformer.
   4. No damage, melting, and clearing curves for fuses.
   5. Cable damage curves.
   6. Transformer inrush points.
   7. Maximum fault-current cutoff point.

3.5 ARC FLASH-STUDY

A. Computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

B. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

C. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

D. Arc Flash Hazard: Provide the following for each piece of equipment, and post this information on the equipment:
   1. Flash hazard boundary.
   2. Cal/cm 2 flash hazard at 18-inches.
   3. PPE-Category appropriate
   4. Shock hazard/voltage
   5. Glove class
   6. Limited approach.
   7. Restricted approach.
   8. Prohibited approach.
   9. Bus: Panel name information.
   10. Completed data sheets for setting of overcurrent protective devices.

E. Arc Flash Hazard Labeling:
   1. Provide 3.5-by-5-inch labels complying with requirements of NFPA-70E at the generator set, each new panelboard, motor control center, switchgear, switchboard, automatic transfer switch and individual feeder protection devices stating the potential flash boundary and the arc flash hazard category, and the type of clothing required to be protected from the potential hazard. Install labels on face of distribution equipment. Self-adhesive computer-generated labels are acceptable. Labels exposed to weather shall be weather and sun-light proof for at least 15 years. Labels shall include all information listed on paragraph above.
   2. Provide at every equipment/electrical/mechanical room where work is done under this project.
   3. A personal protective equipment reference chart for arc-flash categories, 11" x 17" format, posted on wall in room.

END OF SECTION 260574

SECT**ION 262416 – PANELBOARDS**

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section covers construction of lighting and distribution panels, as shown on the drawings.

B. Refer to panelboard schedule and power diagram on drawings for specific requirements of each panel.

C. All panelboards shall meet NEC Articles 408 and 312.

D. All panelboards shall be UL listed and manufactured in accordance with NEMA Standards.

E. Detailed shop drawings of panelboards provided under this Section shall be submitted for Architect's approval. Shop drawings shall show bus and circuit breaker arrangement as shown on Contract Drawings.

PART 2 - PRODUCTS

2.1 GENERAL:

A. The manufacturer shall review the use, details, and methods of installation of his product as indicated and shall disclose to the Architect all deviations from this recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

2.2 MANUFACTURER:

A. All panelboards shall be the products of one manufacturer unless otherwise noted and shall be the standard products of ABB, Square D, or Eaton.

2.3 WIRING TEMPERATURE RATING:

A. Products specified here, including all feeder and branch circuit protective devices shall be UL listed for connection to 75°C conductors, or higher.

2.4 BRANCH CIRCUIT BREAKER PANELBOARDS:

A. Maximum quantity of circuit breakers in a branch circuit panelboard shall not exceed 42 poles unless noted otherwise on drawings.

B. Branch circuit panelboards shall be of the dead-front safety type. The panelboard shall be provided with lugs only in the mains unless main circuit breaker or fuse switches are indicated on the drawings. Panelboard shall be provided with the size and number of single, double, or triple pole branch circuits as indicated on the drawings, except when fused switches are specified for distribution type panelboards. Circuit breakers shall be of the automatic thermal magnetic type, quick-make, and quick-break for manual and automatic operation. All multi-pole breakers shall be common trip. Each panelboard shall be provided with a copper grounding terminal busbar bonded to the cabinet or panelboard frame. Isolated ground bus shall additionally be provided when scheduled on drawings.

C. All circuit breakers shall be bolt-on, calibrated for 40 degrees C. or be ambient compensating. Circuit breakers shall have UL interruption ratings as indicated on the drawings. Series rating for short circuit rating of panelboards and circuit breakers is not acceptable. Breakers used to switch lighting loads shall be labeled accordingly.

D. Each panel, as a complete unit, shall have a short circuit current carrying rating equal to or greater than the integrated equipment rating shown on the panel schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panel Method of testing shall be per UL standard 67. Panels shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed and bear the UL label.

E. Provide, when scheduled, ground-fault protection type branch circuit breakers (GFI) rated to trip when current leakage to ground exceeds 5 milliamperes.

F. Cabinets for branch circuit panelboards shall be minimum 20 inches wide, except otherwise noted for oversized gutters, and shall be provided with not less than 4-inch wiring gutters at the sides, top and bottom. Flush cabinets shall be provided with screw trims having adjustable trim clamps. Trim shall be hinged, door in door construction, and be secured closed with screws. Trims shall be fitted with hinged doors having combination lock and latch. All locks shall be keyed alike. One or more directory holders protected with clear plastic and metal frame as required for rendering entire directory visible shall be mounted on the inside of each door. A neatly typed directory properly identifying each circuit shall be mounted under plastic on inside of each door. Each circuit shall be identified by the type of load and the location of the load, I.E.: “Lighting Rooms 125, 127 and 128”, which is not necessarily what is shown on the contract drawings.

G. Unless otherwise specifically noted all circuit breakers in a panelboard shall have been built by the same manufacturer who built the panelboard. All exterior and interior steel surfaces of panelboard trims shall be finished with gray ANSI-61 paint over a rust-inhibiting phosphatized primer.

H. Panelboards bus work including neutral and grounding busbars shall be copper or aluminum. Neutral buses shall not be less than same rating of the panel but shall be increased in size when so scheduled on drawings. Neutral and ground buses shall have sufficient wiring terminating positions to satisfy oversized feeder neutrals and dedicate branch circuit neutral conductors for each 120-volt circuits and grounding requirements for present and future breakers.

I. A running directory shall be maintained during construction.

J. All exterior and interior steel surfaces of panelboard trims shall be finished with gray ANSI-61 paint over a rust-inhibiting phosphatized primer.

K. Flush mounted panelboards shall have a maximum depth of six inches.

L. Panelboards used as service equipment shall be UL labeled as "Suitable for use as Service Equipment."

M. Panelboards shall have door-in-door feature (hinged front trim) utilizing piano hinged front and mounted with trim screws. The door shall be retained with screws to discourage unauthorized access.

N. Panelboards shall be provided with mains as scheduled on drawings. If mains are not shown provide main circuit breaker matching the ampere rating of the panelboard.

O. Additional requirements for branch circuit panels:
   1. A flush latch and tumbler type lock, so panel door may be held closed without being locked. All such locks shall be keyed alike. Furnish two keys with each lock, or a total of 10 keys for the project.
   2. Cover shall have inside support studs to rest on lower edge of can while being fastened. For flush mounted panelboards, cover fastener hardware shall be concealed behind the hinged door.
   3. Interior trim shall fit neatly between interior assembly and cover leaving no gaps between the two. Where two section panels are specified, both panel trims shall have the same height.

P. Breakers in branch circuit panels shall be physically arranged in locations shown in panel schedules on the drawings. They shall be connected to the phases as shown.

2.5 DISTRIBUTION TYPE PANELBOARDS:
   1. Other than for physical dimensions and type of circuit breakers, all the requirements stated for branch circuit panelboards apply to distribution type panelboards.
   2. Circuit breakers in distribution panelboards shall be bolt-on type.
   3. Circuit breakers covered under this section shall be installed in distribution panels. They shall be one, two or three pole molded case circuit breakers rated 600 VACS as specified on the drawings. Breakers shall be high interrupting construction. All breakers shall be UL and CSA listed, IEC 157-1 rated, meet NEMA standard AB1-1986 and Federal Specification W-C-375B/GEN, when applicable.
   4. Breakers shall be calibrated for operation in 40 deg.C ambient temperature and contain individual thermal and magnetic trip elements in each pole. Breakers with frame sizes ranging from 125 to 800 amperes shall have variable magnetic trip elements which are set by a single adjustment (to assure uniform tripping characteristics in each pole). Breakers rated 600 amperes and higher shall be solid state type with trip functions as specified for similar size breakers in Section 26 2413 – Switchboards. A push-to-trip button shall be provided on the cover for mechanically tripping the breaker. The breaker shall have reverse connection capability and be suitable for mounting and operating in any position.

5. Circuit breakers shall have removable lugs. Lugs shall be UL listed for copper conductors only, rated 75 degrees C. Breakers shall be UL listed for installation of mechanical type lugs.

B. Additional Requirements for Labeling:
   1. For branch circuit panels, directory cards shall be neatly typed to indicate load served by each breaker or fuse. Directory cards shall indicate circuits in a manner analogous to the physical circuit breaker arrangement (i.e., odd numbered circuits in one column, even numbered circuits in another). Mount cards behind heavy plastic shields in metal frame. Mark spares and spaces in erasable pencil only.
   2. Next to each breaker within distribution panels, attach a label indicating load served. Wording shall be as shown on its diagram or schedule on the drawings, except updates per "as-built" conditions.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Front edges of all flush mounted panel housing shall be exactly flush with the finished wall.

B. All equipment, either surface or flush mounted, shall be plumb and level.

C. All openings in boxes, cabinets, or gutters shall be cut or sawed with tools made for that purpose. Burning of openings is unacceptable.

D. All unused openings shall be closed.

E. Only one solid wire is allowable under a screw. Provide an approved lug for connecting stranded wire or more than one solid conductor.

3.2 MOUNTING HEIGHT:

A. Panelboards shall be mounted so that the operating handle of the top unit does not exceed 6'-6". Panels mounted adjacent to each other shall have the top trim level.

3.3 SURFACE MOUNTED

A. Exterior Walls: Panelboards on exterior walls shall be mounted on Unistrut or similar type system, to provide minimum 1" air space between panel and wall.

B. Interior Walls: Panelboards shall be secured to wall in four locations using Ackerman-Johnson or similar fastening devices. Refer to specifications on supporting devices for additional requirements.

C. Panelboard trims shall be flush with enclosure.

D. All panelboard trims shall meet flush with wall when panel is flush mounted.

3.4 NAMEPLATE

A. Provide nameplate in accordance with Section 260553.

3.5 SPARE CONDUITS

A. Provide for each flush-mounted panelboard six (6) spare 3/4-inch conduits from panel to above accessible ceiling of area served (normally a lab) for future extension cap conduits.

3.6 ADJUSTING AND CLEANING

A. Adjust all operating mechanisms for free mechanical movement.

B. Touch up scratched or marred surfaces to match original finish.

C. Adjust trip and time delay settings of all adjustable circuit breaker trips as instructed by the Architect/Engineer. Contractor request in writing from the engineer the settings for the circuit breakers at least 90 days prior to the time scheduled to set the trip functions. Work shall be done by equipment manufacturer's technicians. Adjusting and setting shall be performed by equipment manufacturer's qualified technicians.

3.7 FLASH PROTECTION BOUNDARY:

A. The flash protection boundary and the incident energy for the electrical equipment shall be determined in accordance with IEEE 1584, NFPA 70E and NEC 110-16 requirements. Refer to Section 260574.

END OF SECTION 262416

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 REFERENCE:

A. Wiring devices shall be as indicated and as specified below. All devices shall be UL listed and comply with NEMA WD-1.

1.2 PART NUMBERS:

A. Manufacturer's numbers listed are to establish a type and standard of quality. Any prefix and/or suffix, whether to be added or deleted to complete the number, shall be the Contractor's responsibility. This applies specifically but not exclusively to color identification, grade, and compliance with standards and specifications.

1.3 GRADE:

A. Only the highest quality device in a category (single pole toggle, conventional duplex, etc.) will be acceptable. The addition or deletion of a prefix or suffix to change the device to a lower grade will not be acceptable.

1.4 COLOR:

A. Unless indicated otherwise, color of 15 and 20 ampere devices shall be gray for all normal circuits and red for emergency circuits. Colors shall be that of the molding compound. Painting will not be acceptable.

1.5 WIRING:

A. Unless noted SWO (side wired only), devices shall be back and side wired screw type terminals. Pigtails will not be acceptable unless noted otherwise.

1.6 GROUNDING:

A. All devices shall separate grounding screw lugs for a direct, green insulated conductor connection to the equipment grounding conductor.

1.7 WIRING TEMPERATURE RATING:

A. Each wiring device shall be UL listed for use with 75 degree C rated wire or higher.

1.8 MANUFACTURER:

A. All devices shall be by a single manufacturer unless noted otherwise or not commercially available.

B. Furnish manufacturer's data and literature for each item provided under this Section.

PART 2 - PRODUCTS

2.1 SWITCHES:

A. All switches shall be 20 amps, 120/277 VAC unless indicated otherwise. Switches shall comply with Federal Specification W-S-896 when commercially available.

DEVICE	MANUFACTURER		
	P&S	Hubbell	Bryant
Toggle, 1-pole	PS20AC1	HBL1221	4901
Toggle, 2-pole	PS20AC2	HBL1222	4902
Lighted toggle, 1-pole			
Toggle, 3-way	PS20AC3	HBL1223	4903
Key-operated, 1-pole	PS20AC1-L	HBL1221-L	4901-L
Key-operated, 2-pole	PS20AC2-L	HBL1222-L	4902-L
Key-operated, 3-way	PS20AC3-L	HBL1223-L	4903-L
Lighted toggle, 1-pole 277 volts, off light, (ivory	PS20AC1-ISL	HBL1221-IL7	4901-GLI
Lighted toggle, 3-way 277 volts, off light, (ivory	PS20AC3-ISL	HBL1223-IL7	4903-GLI
Weatherproof w/plate 1-pole, 120/277V, 20A, SWO			1781
Weatherproof w/plate 1-pole, 125-volt,			

10A, SWO	1432
Weatherproof w/plate	
3-way, 120/277V,	
20A, SWO	

2.2 RECEPTACLES:

A. All convenience duplex receptacles shall be 20 amperes, specification grade, 125 VAC (NEMA 5-20R) unless indicated otherwise. All receptacles other than conventional duplex shall be as shown in the following table. Receptacles shall comply with Federal Specification W-C-596 when commercially available. Receptacles shall have a solid brass mounting strap with non-riveted, integral one-piece grounding system.

DEVICE	MANUFACTURER		
	P&S	Hubbell	Bryant
Duplex, NEMA 5-20R, 20A, 125V	5362-A	HBL5362	5362
Duplex, NEMA 5-20R, 20A, 125V Tamper Resistant	TR63	BR20TR	CBRS20TR
Hospital Grade Duplex, NEMA 5-20R, 20A, 125V	8300H	HBL8300	8300
Hospital Grade Duplex, NEMA 5-20R, 20A, 125V, GFI	2094-HG	GF8300-H	GF83
Hospital Grade Duplex, NEMA 5-20R, 20A, 125V Tamper Resistant	TR63H	HBL8300SG	GF83TR
GFI duplex, 3-wire feed through 20A, 125V NEMA 5-20R	2094	GFR5352	GF53
Hospital Grade Duplex, NEMA 5-20R, 20A, 125V, GFI Tamper Resistant	2095HGTR	GFR8300XTR	GF83TR

2.3 MISCELLANEOUS DEVICES:

A. Special Devices:

NEMA Configuration	P&S	Hubbell	Bryant
5-30R	3802	9308	9530FR
6-20R	5862	5462	5462
6-30R	3801	9330	9630FR

B. Interior Weatherproof Receptacles: shall be duplex NEMA 5-20R with gasketed weatherproof cast aluminum plate UL listed for wet and damp locations with cover closed, vertical mounting except as indicated otherwise.

C. Exterior Receptacles: shall be duplex NEMA 5-20R, with built-in GFI, with enclosure listed as weatherproof when receptacle is being used. Exterior receptacles shall be listed as weather-resistant in accordance with NEC 2014 requirements. Exterior receptacles shall have corrosion resistant gasketed metallic covers with baked aluminum finish with NEMA 3R rating while in use. Plastic covers are not acceptable.

2.4 OUTLET BOXES:

A. Refer to Section 26 05 41 for outlet boxes, floor boxes and poke-through devices. Outlet boxes for devices with weatherproof cover shall be as required by specified cover. In mechanical rooms specified with weatherproof covers, outlet boxes shall be surface mounted if required by cover plate.

2.5 ARCHITECTURAL WALLBOX DIMMERS AND RELATED SWITCHES

A. All devices shall be UL listed specifically for the required loads (i.e. incandescent, fluorescent, low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers shall not be acceptable.

B. Manufacturer shall maintain ISO 9001 certification. Provide a copy of the certificate as part of the submittal.

C. All dimmers and switches shall incorporate an air gap which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of UL 20 and UL 1472 for air gap switches in incandescent dimmers.

D. All dimmers and switches shall provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.

E. Dimmers and switches shall meet ANSI/IEEE Std. C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.

F. Dimmers and switches shall meet the UL 20 and UL 1472 limited short circuit test requirement for snap switches.

G. Dimmer control shall be linear slide. Dimmer shall provide a smooth and continuous Square Law dimming curve.

H. Dimmer shall be voltage regulated so that +10% variation in line voltage shall cause not more than a +5% variation in load voltage when dimmer is operating at 40V (5% light output).

I. Dimmers shall utilize an LC filter network to minimize interference with properly installed radio, audio, and video equipment.

J. Dimmer control slider shall be captured.

K. Dimmers shall be fully compatible with furnished ballasts and drivers.

L. Faceplate shall snap on to device with no visible means of attachment. Heat-fins shall not be visible on front of device. At locations with multiple devices, one seamless, multi-gang faceplate shall be provided. Contractor is responsible for coordination of proper backbox size and faceplate size.

M. Dimmers, switches, and faceplates shall be Lutron Nova T* style. Equivalent commercial specification grade dimmer from Pass & Seymour or Leviton are equally acceptable. Provide, as part of this section, all additional relays, booster power supplies, outlet boxes and wiring required to accomplish the dimming function, whether shown on drawings or not.

PART 3 - EXECUTION

3.1 GENERAL:

A. Devices shall be mounted tightly to boxes and be adjusted plumb and level. Where two or more devices are indicated for gang installation, they shall be trimmed with gang type plates.

B. Ground each receptacle by means of a separate code size ground wire (#12 minimum) connecting the receptacle ground terminal to the grounded conduit system.

3.2 GFI RECEPTACLES:

A. Ground fault interrupter type receptacles shall be installed as required by NEC. GFI receptacles shall be connected in a way that also provides protection to other regular receptacles connected downstream on same circuit. (Requires separate neutral). *GFCI shall comply with January 1, 2003, UL943 Revisions. SafeLock ™ Protection: If critical components are damaged and ground fault protection is lost, power to receptacle is disconnected.*

3.3 ORIENTATION OF RECEPTACLES:

A. Generally, receptacles shall be mounted vertically. Receptacles mounted over counters, back-splashes, etc., shall be mounted horizontally.

B. All vertically mounted receptacles shall be mounted with the grounding blade up.

C. All horizontally mounted receptacles shall be mounted with the neutral blade up.

3.4 RECEPTACLE LABELING:

A. Each receptacle, whether mounted in wall or in multi-outlet assembly, shall have a permanent label indicating circuit and panel number. Refer to Section 26 0553 for requirements. The contractor is responsible for taking the necessary steps to make sure that each receptacle ends up with the correct plate/circuit number and it is not all messed up when the walls are painted. The A/E will spot check receptacle circuit numeration for correctness during final inspection.

3.5 INSTALLATION OF DIMMERS:

A. Dimmers shall be wired to separate individual neutral circuits.

B. Dimmers shall be mounted end to end on ganged single or double device boxes recessed in wall. Maximum number of dimmers on a single ganged assembly shall be six. When additional dimmers are required, install dimmers on two ganged assemblies, each of equal number of devices with at least 6 inches of vertical separation.

END OF SECTION 262726

SECTION 262727– COVER PLATES

PART 1 - GENERAL

1.1 GENERAL:

A. Cover plates shall accommodate the devices installed in the outlet boxes. Where more than 1 device is indicated at the same location, a multiple ganged plate shall be used. All coverplates shall be provided by the Contractor except as otherwise noted.

B. Final telephone and communications equipment outlet covers will be provided by others.

C. Plates covering boxes for future systems shall be blank.

D. Plates shall be compatible with the device configuration.

E. Cover plates shall be UL listed and shall comply with Federal Specification W-P-455 and NEMA WD-1.

F. All cover plates over flush wall boxes shall meet flush with wall.

G. All coverplates shall be manufactured by a single manufacturer unless noted otherwise or not commercially available.

H. Furnish manufacturer's data and literature for each item provided under this Section.

PART 2 - PRODUCTS

2.1 COVERPLATES:

A. Type 302 stainless steel, .040" thick, satin finish, smooth surface, coverplates shall be used for all devices unless noted otherwise.

B. Manufacturer:
   1. Cover plate shall be manufactured by Pass & Seymour, Hubbell, or Bryant unless noted otherwise.

END OF SECTION 262727

SECTION 262813 – FUSES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The contractor shall provide fuses as indicated and as specified herein for overcurrent protection of conductors and equipment rated 600 volts and lower.

1.2 SUBMITTALS:

A. Furnish manufacturer's catalog data for all products specified here.

1.3 WIRING TEMPERATURE RATING:

A. All products specified here shall be rated for connection to 75 deg C wiring, or higher.

PART 2 - PRODUCTS

2.1 FUSE DESIGN:

A. All fuses shall have contact surfaces treated to maintain conductivity and tubing of dimensionally stable not degraded by extreme conditions of humidity and aridity.

B. Branch circuit and feeder fuses for other than motor circuits or individual safety switches, rated 1-600 amperes shall be UL listed and labeled duel-element, time delay, Class RK1, with 200,000 A RMS interrupting rating. Fuses shall be Buss, or equivalent from Gould Shawmut or LittelFuse.

C. Fuses for motor circuits and for installation in individual safety switches shall be UL listed, dual-element, time-delay, Class RK1 with 200,000 A RMS interrupting rate from Buss, Gould or LittelFuse.

D. Fuses rated 601 amperes and larger shall be UL Class L 100%, dual-element continuous load rated, Gould Shawmut A4BQ, Buss KRP-C, Littelfuse, KLPC, or approved equivalent.

E. Fuses used with power circuit breakers shall be current limiting of the type and ratings, as recommended by switchgear manufacturer.

PART 3 - EXECUTION

3.1 GENERAL:

A. Provide fuse removal tool.

B. Fuses shall be of the proper voltage class corresponding to the distribution system in which it is used.

C. Fuses shall not be shipped in equipment but shall be installed prior to energizing equipment.

D. The fuse type and rating marked on fuse barrels shall be totally visible when installed.

E. All fuses installed in each fusible switch shall be of the same manufacturer size and type.

END OF SECTION 262813

SECTION 262816 – SAFETY DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Work included shall include but not necessarily be limited to the following:
   1. Fusible safety and disconnect switches
   2. Non-fusible safety and disconnect switches

1.2 SUBMITTALS:

A. Provide manufacturers catalog data for all products specified here.

PART 2 - PRODUCTS

2.1 WIRING TEMPERATURE RATING:

A. Products specified here shall be UL listed for connection to 75-degree C conductors, or higher.

B. All switches specified here shall be supported to withstand seismic disturbances.

C. Safety Disconnect Switches: Provide fusible and/or non-fusible heavy-duty safety and disconnect switches with ratings and fuse types and sizes as shown on the drawings. Provide horsepower rated switches for use as motor circuit disconnecting means, in accordance with the individual manufacturer's published ratings. For applications in excess of switch ratings provide non-automatic molded cast circuit breakers rated not less than 125% of motor full load current. Provide each switch with the following:
   1. Line terminal shields
   2. Visible blade
   3. Positive, quick-make, quick-break interrupter operating mechanism.
   4. Reinforced fuse clips where required.
   5. Handle whose position is easily recognizable and can be multiple padlocked in the "OFF" position.
   6. Defeatable door interlocks that prevent the door from opening when the operating handle is in the "ON" position.
   7. Factory installed ground lug.
   8. 'R' type fuse holders
   9. Auxiliary NOC & NCC for disconnect switches used on power circuits to elevators and VFD controllers.

D. Enclosure: Provide these in accordance with the following schedule:
   1. NEMA 1 enclosure for dry, indoor areas.

2. NEMA 3R for damp or outdoor locations, except when NEMA type 4X is specified on drawings.

E. Manufacturer: Provide safety/disconnect switches as manufactured by one of the following:
1. Square D, GE or Eaton.

PART 3 - EXECUTION

3.1 INSTALLATION OF WORKMANSHIP:

A. Enclosure: Mount switch enclosure rigidly and with proper alignment on the building structure one (1) inch off the wall and with top of enclosure 6'-0" above finished floor. Use steel supports fabricated from standard rolled structural steel shapes. Install supports in such a manner as to no block the vertical flow of air between enclosure and wall.

B. Wiring: Install all incoming and outgoing power circuits. Wire switches intended for VFD drive controlled motors in a way that opens the input circuit to the VFD drive, rather than the output, when the switch is in the open position.

C. Fuses: Install fuses, where required, of the proper type and ratings as shown on the drawings.

D. Locate disconnect switches as close as possible to the equipment being protected, at accessible location.

E. Provide nameplate identifying equipment served and circuit serving equipment.

F. Switches shall be securely fastened to the supporting structure or wall utilizing four 1/4-inch minimum size, bolts. Switches shall not be mounted in an inaccessible location or where passageway to the switch may become obstructed. Provide suitable angle iron supporting structure for switches and circuit breakers when wall space is not available for support. Supporting structure shall be attached to floor slab with 3/8-inch expansion shields.

END OF SECTION 262816

SECTION 263200 – STANDBY POWER SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Standby power system shall be provided and installed complete in every respect so that upon failure of the normal source of power from the electrical utility, a separate local source of power shall automatically be provided to this building's power distribution systems.

B. The Contractor shall furnish, install, and connect a diesel engine driven generator set, complete as hereinafter specified. The installation shall include exhaust silencer, exhaust pipe, electrical starting system, automatic transfer switches, outdoor weather – protective enclosure, fuel tank and all appurtenances needed for a complete installation as specified herein and as shown on the drawings.

C. Refer to Section 263214 for automatic transfer switches that must be furnished as part of engine generator set purchase.

D. Refer to electrical drawings for additional requirements.

E. The equipment specified here shall be anchored, inspected, tested, and certified to resist equivalent static forces and displacements for the stated seismic design category in accordance with requirements of NCSBC.

F. Electrical equipment specified here and in Section 263214 shall have an Importance factor (Ip) of 1.0.

1.2 REFERENCES AND STANDARDS:

A. The generator set covered by these specifications shall be designed, tested, rated, assembled, and installed in strict accordance with all applicable standards below:

1. CSA C22.2 No14
2. CSA 282
3. CSA 100
4. EN61000-6
5. EN55011
6. FCC Part 15 Subpart B
7. ISO8528
8. IEC61000
9. UL508
10. UL2200
11. UL142
12. Designed to allow for installed compliance to NFPA 30, NFPA 37, 70, NFPA 99, and NFPA 110.

1.3 REQUIREMENTS, CODES AND REGULATIONS:

A. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a Manufacturer who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1.4 MANUFACTURER AND SUBSTITUTION:

A. Equipment specified here is based on Caterpillar products. Equipment products from Cummins, Kohler, Generac, or Detroit Diesel are acceptable subject to the conditions stipulated.

B. Proposed deviations from the specifications shall be treated as follows:

1. Substitution Time Requirement: Any proposed deviation or requests for substitutions for other than Caterpillar, Cummins, Kohler, or Detroit Diesel shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be addenda only.

1.5 SUBMITTALS:

A. Engine-generator submittals shall include the following information:

1. Factory published specification sheet.
2. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.
3. Dimensional elevation and layout drawings of the generator set enclosure and transfer switchgear and related accessories.
4. Weights of all equipment.
5. Concrete pad recommendation, layout, and stub-up locations of electrical and fuel systems.
6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, control panel, and remote alarm indications.
7. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.
8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
9. Generator resistances, reactance’s and time constants.
10. Generator locked rotor motor starting curves.
11. Manufacturer's and dealer's written warranty.

B. Approval of the contractor’s proposed generator set is conditional to having completed and submitted the overcurrent protective device coordination study at least two weeks prior to submitting the shop drawings. If the contractor chooses to submit the proposed generator set for approval prior to the submittal of the coordination study, it shall be with the stipulation that any change in circuit breaker required to comply with the recommendations of the

coordination study shall be accomplished without extra charge to the project, the owner, or the A/E.

1.6 SYSTEM RESPONSIBILITY

A. Generator Set Distributor:

1. The completed engine generator set shall be supplied by the Manufacturer's authorized distributor only.

B. Requirements, Codes and Regulations

1. The equipment supplied and installed shall meet the requirements of NEC and all-applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.

C. Automatic Transfer Switch:

1. The automatic transfer switches specified in Section 263214 shall be supplied by the generator set manufacturer to establish and maintain a single source of system responsibility and coordination.

D. Warranty:

1. Five (5) Year Standby (ISO 8528-1: ESP) Generator Set Warranty

2. The manufacturer's standard warranty shall in no event be for a period of less than five (5) years from date of final inspection and acceptance of the system and shall include repair parts, labor, travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

E. Parts and Service Qualifications:

1. Service Facility: The engine-generator supplier shall maintain 24-hour parts and service capability within 100 miles of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.

2. Service Personnel: The dealer shall maintain qualified factory trained service personnel.

1.7 SERVICE MANUALS AND PARTS BOOKS:

A. The system manufacturer's authorized local dealer shall furnish four copies each of the manuals and books listed below for each unit under this contract:

1. OPERATING INSTRUCTIONS - with description and illustration of all switchgear controls and indicators; and engine and generator controls and indicators.

2. PARTS BOOKS – that illustrate and list all assemblies, subassemblies, and components, except standard fastening hardware (nuts, bolts, washers, etc.).

3. PREVENTIVE MAINTENANCE INSTRUCTIONS - on the complete system that cover daily, weekly, monthly, biannual, and annual maintenance requirements and include a complete lubrication chart.

4. ROUTINE TEST PROCEDURES - for all electronic and electrical circuits and for the main AC generator.

5. TROUBLESHOOTING CHART - covering the complete generator set showing description of trouble, probable cause, and suggested remedy.

6. RECOMMENDED SPARE PARTS LIST - showing all consumables anticipated being required during routine maintenance and test.

7. WIRING DIAGRAMS AND SCHEMATICS - showing function of all electrical components including monitoring network and interface with future building automation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. The generator set shall be standby duty rated with kW/kVA as shown on the drawings, 1800 RPM, 0.8 power factor, 208 V, 3-Phase, 60 hertz, including radiator fan and all parasitic loads as indicated on drawings. Generator set shall be sized to operate at the specified load at a maximum ambient of 104F (40.0C) and altitude of 800.0 feet.

B. Standby Rating as defined by the following:

1. Typical Load Factor = 70% or less with variable load
2. Typical Hours per Year = 200 hours
3. Maximum Expected Usage = 500 hours/year
4. Typical Peak Demand = 80% of ESP rated kW with 100% of rating available for the duration of an emergency outage

2.2 POWER CABLE CONNECTIONS:

A. Provide bus work and generator power connection termination box sized in compliance with NEC Article 312 and mechanical type lugs to terminate outgoing power conductors.

2.3 MATERIALS AND PARTS:

A. All materials and parts comprising the unit shall be new and unused.

2.4 ENGINE:

A. The engine shall be diesel fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. The in-cylinder engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder.

B. Emissions requirements / certifications of this package: The proposed generator set shall be EPA Tier II Certified and in compliance with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier II emissions standards per ISO 8178 - D2 Emissions Cycle at specified ekW /bHP rating. Utilization of the "Transition Program for Equipment Manufacturers " also known as "Flex Credits" to achieve Tier II certification is not acceptable.

C. Engine Governing: The engine governor shall be an electronic Engine Control Module (ECM) with 24-volt DC Electric Actuator. The ECM shall be enclosed in an environmentally sealed, die-cast aluminum housing which isolates and protects electronic components from moisture and dirt contamination. Speed droop shall be adjustable from 0 (isochronous) to 10%, from no load to full rated load. Steady state frequency regulation shall be +/- 0.25%. Speed shall be sensed by a magnetic pickup off the engine flywheel ring gear. A provision for remote speed adjustment shall be included. The ECM shall adjust fuel delivery according to exhaust smoke, altitude, and cold mode limits. In the event of a DC power loss, the forward acting actuator will move to the minimum fuel position.

2.5 GENERATOR:

A. The generator shall be a synchronous, three phase, four pole, random wound, single or double bearing, and IP23 drip proof. Bearing(s) shall be double shielded and maintenance free. The insulation system shall meet NEMA MG 1 and UL1446 standards for Class H insulation. Generator temperature rise shall be limited to NEMA MG1 temperature limit of 105C at a 40C ambient. The excitation system shall enable the generator to sustain 300% of rated current for ten seconds during a fault condition and shall improve the immunity of the voltage regulator to non-linear distorting loads. Provide PMG or AREP excitation.

2.6 DIGITAL VOLTAGE REGULATOR

A. The digital voltage regulator shall be microprocessor based with fully programmable operating and protection characteristics. The regulator shall maintain generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS in three phases of alternator output voltage or operating in single phase sensing mode. The voltage regulator shall include a VAR/Pf control feature as standard. The regulator shall provide an adjustable dual slope regulation characteristic to optimize voltage and frequency response for site conditions.

B. The voltage regulator shall communicate with the Generator Control Panel via a J1939 communication network with generator voltage adjustments made via the controller keypad. Additionally, the controller shall allow system parameter setup and monitoring, and provide fault alarm and shutdown information through the controller. A PC-based user interface shall be available to allow viewing and modifying operating parameters in a window's compatible environment.

C. Provide isolation transformer ahead of voltage regulator.

2.7 GENERATOR CONTROL CABINET:

A. Provide control cabinet, mounted on shock absorbers with accessories as outlined below.

1. *Buss bar with compression lugs to accept output conductors.*
2. AC Ammeter 3-1/2-inch panel, type 2 percent accuracy.
3. AC Voltmeter 3-1/2-inch panel type 2 percent accuracy minimum.
4. 3 Current Transformers
5. Ammeter-Voltmeter Phase Selector Switches, including voltage phase-to-phase
6. Frequency Meter - Direct Reading type, 2 percent accuracy
7. Panel Lights
8. Duplex NEMA 5-20R Grounding Convenience Receptacle
9. Manual Start-Stop Control.
10. Automatic Start-Stop control.
11. Remote Start-Stop Control as previously specified.
12. Two Normally Open and two Normally Closed Auxiliary Contacts for actuation of external control circuits.
13. Alarm Lights:
    a. High Water Temperature
    b. Low Oil Pressure
    c. Battery Problem
    d. Overspeed
    e. Overcrank
    f. Low Fuel
    g. Summary Alarm
14. 3-Position Selector Switch
15. Relays - heavy duty industrial type, 10-ampere, self-cleaning contacts.

16. An automatic control panel of the three cranking and three rest period type with alarm to start the engine on failure of normal source of power shall be supplied. The controls shall be such as to shut down the engine on return of normal power. The controls shall contain all auxiliaries as recommended by the engine manufacturer for proper, sure, quick starting of the engine.
17. Provide automatic exerciser with time clock.

B. Provide components required to continuously monitor the integrity of the remote start circuit(s) between the generator(s) and transfer switch(s). Loss of integrity of the control wiring shall initiate visual and audible annunciation of generator malfunction at local and remote annunciators.

2.8 REMOTE ALARM PANEL:

A. Provide remote mounted annunciator panel with stand-by battery power. Annunciator shall give visual/audible alarm of impending alarm conditions as required by NFPA 101 and NFPA 110 - Level 1, but not less than what is specified here. Annunciator shall be surface mounted on the wall of the main electrical room.

B. Include the following functions as a minimum:
1. Generator Run Status
2. Battery Charger Malfunction
3. Set Derangement
4. No Fuel
5. Overheating
6. Low Oil Pressure
7. Summary Alarm

2.9 SITE MONITORING CAPABILITY:

A. The generator sets shall be provided with the means to interface via digital network with the building automation system (BAS) based on Modbus LonWorks or BACNET over Ethernet communication, as specified here.

B. Refer to Section 250900 and electrical drawings for additional information.

C. The communication protocol shall be Modbus, LonWorks or BACNET over Ethernet. The equipment shall have the capability to interface with BAS using one of the specified protocols, as directed by BAS supplier.

D. The equipment manufacturer shall supply as part of the equipment package, a gateway or converter that will act as a protocol translator to convert the native equipment protocol to Modbus, LonWorks and BACNET over Ethernet protocol. The gateway or converter shall be installed within building in a suitable enclosure. Provide required shield wiring, suitable for installation in underground conduit, between gateway/converter and generator set.

E. Any additional wiring or programming associated with configuring any gateways or converters is the responsibility of the equipment manufacturer.

F. In addition to the above network requirements, provide dry contacts to monitor functions as specified under remote alarm annunciator.

G. Submittals:

1. As part of the equipment drawing submittals, the equipment manufacturer will provide a drawing that clearly indicates the termination points for Modbus, LonWorks or BACNET over Ethernet communications. If the manufacturer requires a gateway or converter, the drawings will also include drawing(s) that clearly identify dimensions, mounting requirements, power requirements and interconnections for the converters or gateway.

2.10 PIPING:

A. Electrical contractor shall provide all necessary fuel and exhaust piping unless otherwise specified.

2.11 COOLING SYSTEM:

A. The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 deg F ambient air entering the room or enclosure. The generator set supplier is responsible for providing a properly sized cooling system based on the installed static pressure restriction.

2.12 FUEL SYSTEM:

A. The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300 deg F and 100 psi.

2.13 STARTING SYSTEM

A. Starting Motor: A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Batteries: Batteries - A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system.

C. Battery Charger:

1. A UL listed/CSA certified 10-amp voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float and equalize charge settings, with provisions to automatically switch between the two modes. It shall maintain its rated output voltage within ±0.2% with AC input variation of ±10%. Operational monitors shall provide with individual form C contacts 4 amps, 120

VAC, 30VDC for remote indication of battery charger malfunction, low battery voltage, and high battery voltage. Charger shall include an Analog DC voltmeter and ammeter and fused AC input and DC output and shall be wall mount type in a NEMA 1 enclosure. Charger shall be capable of recharging a fully discharge set of batteries in eight (8) hours.

2. Battery charger shall be of the automatic, sold state, current limiting, float equalizing type. It shall maintain the battery at normal capacity and recharge battery after cranking. The charger shall accept 120-volt input with appropriate output. It shall be capable of automatically switching from one rate to another rate to meet the needs of the discharged batteries. It shall also have overload protection, voltage surge suppressers, D.C. ammeter, D.C. voltmeter, low D.C. voltage alarm relay; with a minimum continuous output of 10 amperes D.C. battery charger malfunction alarm contact, and third-party listed.

2.14 JACKET WATER HEATER:

A. An engine mounted, thermostatically controlled, immersion type engine coolant heater shall be provided to ensure a minimum acceptable coolant temperature. Heater voltage rating shall be 208 volts.

B. Provide a contactor in an appropriately rated NEMA enclosure for each heater to automatically disconnect the heater when the engine is running.

2.15 FUEL SYSTEM:

A. The fuel system shall be of the direct injection type in which fuel is sprayed directly into the cylinder or through a pre-combustion chamber through a spring-loaded nozzle, and combustion shall take place without the use of air cells or auxiliary chambers.

B. Sub-base Fuel Tank:

1. Sub-base: Fuel storage tank shall meet all EPA requirements and tank shall be of double wall construction to provide secondary containment of fuel in event of a weld seam failure in the fuel storage section of the tank. Rupture basin section of tank shall be a minimum of 10% of the actual fuel tank capacity.

2. Tank shall be designed for storage of diesel fuel at atmospheric pressure. The fuel tank shall be designed for support of diesel generator sets, industrial engines with PTO and or pumps. Tank shall be for a stationary installation in accordance with the standard for flammable and combustible liquid code of national fire protection association, NFPA #30. The standard for installation and use of stationary combustion engine and gas turbines, NFPA #37 and the standard for emergency and standby power systems, NFPA #110. Tank shall be UL listed.

3. Tank shall have a minimum useable capacity to run engine for 12 hours at full standby rating and shall have a 5-year warranty against corrosion. Tank shall be constructed of 10-gauge steel plates for both inner and outer skins. All sides and ends and internal cross members/baffles will be constructed of various structural steel channels and I-beams depending on fuel capacity

required. All steel shall be wired brush cleaned removing all surface rust and mill scale to insure no foreign debris enters the fuel storage area. Tank shall be especially treated against corrosion and shall have a 5-year warranty against corrosion damage. Tank exterior shall be treated as specified for the generator set enclosure.

4. All welding shall be performed by A.W.S. certified welders, documentation of welder certification shall be provided with bid upon customer request. Construction to meet Seismic Zone Two Requirements. Each tank shall have a provision for normal and emergency venting. Vent sizes will be calculated using 100% of the wetted surface area of the four sides and in accordance with U.L.142 specifications.

5. The vent openings shall be identified and be in addition to filling, withdrawal, or monitoring openings listed below:
    a. 2-inch N.P.T. Phoenix flanged manual fill
    b. 3/4-inch N.P.T. Phoenix flanged main tank drain with plug
    c. 3/4-inch N.P.T. Phoenix flanged secondary tank drain with plug
    d. 3/4-inch fuel withdrawal pipe extended to bottom of main tank and mitered 45 degrees on pickup end
    e. 1 1/2-inch N.P.T. Phoenix flanged fuel level monitoring opening in main tank for; Rochester model #8680 direct reading magnetic liquid level gauge
    f. 1 1/2-inch N.P.T. Phoenix flanged leakage detection system for secondary tank; gem #LS-1800 wired for remote annunciation
    g. 1 1/2-inch N.P.T. Phoenix flanged low fuel level monitoring system for main tank; Gem #LS-1800 signals light either local or remote

6. Fuel tank shall have cross members/baffles strategically located to accept engine mounting rails in addition to evenly distributing weight of Zone 4 vibration spring loaded isolated package generator sets

C. Testing:

1. Before painting each tank shall be leak tested at an internal air pressure of 5 psig on both main tank and secondary tank for a period of (1) hour. Using a leakage detection solution in accordance with UL #142 shall check both tanks.

2. The tank shall incorporate an electrical access area through both the main and secondary tanks located directly below the generator exciter box to allow ample area for connection of generator output leads.

3. Lift eyes shall be designed for lifting a minimum of (2) time's maximum rated load of complete package consisting of a minimum of (4) 1-inch lift

D. Fuel Lines:

1. The fuel supply and return lines shall be black iron not less than 3/4" and 1", respectively. The fuel and overflow lines shall be looped near the engine. The construction and installation of the fuel piping and valves including solenoid valve in supply line shall conform to the applicable requirements of NFPA Standard No. 30.

2.16 FUEL:

A. Contractor shall provide, as part of Division 26 work, a full tank of fuel at no extra cost to the Owner.

2.17 EXHAUST PIPING:

A. Exhaust piping shall be black seamless or galvanized steel schedule 40 with butt welded or flanged fittings as required of the size recommended by the engine manufacturer. A minimum length of 18 inches of flexible exhaust hose shall be installed between steel piping and engine. Exhaust silencer shall be critical type of the size and type required by the engine manufacturer. Exhaust piping and silencer shall be installed on and supported from set. Piping and silencer exposed to the weather shall be insulated with 4-inches of calcium silicate insulated with canvas cover and outer aluminum sheet jacket with waterproofing treatment.

2.18 OUTDOOR NON-WALK-IN ENCLOSURE:

A. Provide outdoor enclosure of tamper resistant construction to protect engine generator set against the environment. Housing shall be the manufacturer's standard color. Housing shall be non-walk-in type. Provide suitable reinforced steel concrete pad. Concrete shall be 3000 psi. Provide power connection to battery charger.

B. Provide anti-freeze in radiator for protection of cooling system in -15-degree temperatures.

C. Provide tamper-proof locks and keys.

D. Provide set mounted DC (battery) lights.

E. Provide critical type exhaust silencer and exhaust piping.

F. Provide all necessary louvers.

G. Steps and Platforms: Provide steps and platform if the output *leads* are higher than 6'-6" from adjacent ground or pavement.

H. Anchor Bolts: Galvanized steel, of types and sizes as required to comply with the NCSBC seismic anchoring requirements, per Section 260529.

I. Vibration Isolators: Provide vibration isolators, spring/pad type with bumper restraint or snubber as required by the NCSBC, quantity as recommended by the generator set manufacturer.

J. All materials used in the mounting and installation of the load elements shall be suitable for the temperatures encountered, both in normal operation and under fault conditions.

K. Materials in direct contact with the element wire shall be ceramic. Plastics and glass reinforced plastic materials and flammable materials are not acceptable materials of construction for installation, support and mounting of load elements or in the construction of the load bank hot air duct.

L. Base: The generator sets shall be mounted on heavy structural steel base. Steel base shall be mounted on raised concrete base 12" in depth 6" above grade or pavement on vibration isolators. Vibration isolators shall consist of a one-piece elastomeric unit having all metallic surfaces covered with elastomeric material to resist corrosion and environmental degradation. Isolators shall have a non-skid thread integrally molded into the top and bottom contact surfaces.

M. Provide vertical discharge of cooling system exhaust air.

2.19 REMOTE EMERGENCY STOP PUSHBUTTON:

A. Surface mounted in weatherproof enclosure. Pushbutton shall be protected from accidental operation. Provide label.

PART 3 - EXECUTION:

3.1 INSTALLATION:

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products. Of special importance is compliance with NCSBC seismic design and anchoring requirements and Section 260529.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on electrical concrete pad. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and requirements of NCSBC and Chapters 16 and 17, and section 260529.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

F. Incoming electrical conduits shall be made watertight as they penetrate through concrete base and fuel tank opening and shall transition to flexible conduit above the enclosure floor level.

G. Contractor shall provide, at contractor’s expense, a full tank of diesel fuel.

3.2 SUPERVISION:

A. The installation shall be supervised, checked, and tested by a qualified representative of the engine-generator manufacturer, and written certification of test sent to Engineer by engine-generator manufacturer's representative.

B. The power generating unit supplier shall include the services of Field Engineers and circuit breaker manufacturer technicians for the following:

1. Supervision of installation of power unit.
2. Proper operation of the power unit to the generator circuit breaker.
3. Start-up test of power unit.
4. Acceptance test of power unit.
5. Check-out of all operating functions of power unit.
6. Set trip functions of circuit breakers

3.3 START-UP AND TESTING:

A. Coordinate all start-up and testing activities with the Engineer and Owner. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:

1. NFPA 110 Load Test Requirements:

a. Verify that the equipment is installed properly.

b. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.

c. Test all alarms and safety shutdown devices for proper operation and annunciation.

d. Check all fluid levels.

e. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.

f. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.

g. Connect the generator to building load and verify that the generator will start and run all designated loads.

2. The system shall be tested under full load and monitor the following readings:

a. Oil pressure
b. Coolant temperature
c. Battery charge rate
d. AC volts

e. AC Amperes- all phases
f. Frequency
g. Kilowatts
h. Ambient Temperature
i. The proper hook-up with Building Automation System shall be verified

B. The generator supplier shall conduct load bank test in the presence of Owner using portable load banks provided under this section. The testing shall be in accordance with NFPA110, Chapter #7.13 requirements. All fuel used during tests shall be provided by supplier of units. After the testing is completed a full tank of fuel shall be provided at contractor's expense. Diesel fuel shall be of the type presently required by EPA and Mecklenburg County. Copy of the generator's load test report shall be sent to the Engineer of Record and the Owner. After testing, provide anti-aging and cold weather treatment for fuel.

3.4 FINAL ACCEPTANCE:

A. The installation shall be supervised, checked, and tested by a qualified representative of the engine generator manufacturer. Written certification shall be sent to the designer and/or Owner prior to final acceptance.

3.5 TRAINING

A. On-Site Training: Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

3.6 SPARE PARTS:

A. Provide the following parts:
1. Two fuel oil filters
2. Two lube oil filters
3. Two water filters
4. Two pre-charged water filter cartridges
5. Two air cleaners
6. One set valve cover gasket.
7. One alternator belt
8. One fan belt
9. One set of fuses for engine controller
10. One hydrometer, battery

END OF SECTION 263200

SECTION 263214 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Furnish and install automatic transfer switch so that upon failure of the normal source of power from the electric utility, a separate local source of power originating at the facility engine generator set shall automatically be provided to the power distribution systems.

B. The equipment specified here shall be anchored, inspected, tested, and certified to resist equivalent static forces and displacements for the stated seismic design category in accordance with requirements of NCSBC.

1.2 QUALITY ASSURANCE:

A. Products specified here shall be furnished as part of Section 263200 – Standby Power Systems. The manufacturer shall review the use, details, and methods of installation of his product as indicated and shall disclose to the Engineer all deviations from his recommended use and method of installation and shall also disclose to the Engineer his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. The equipment and methods specified here shall be listed under the following specifications in their current edition:

B. UL Standards:

1. Transfer Switches, UL 1008

1.4 WARRANTY:

A. The automatic transfer switches shall be warranted by the manufacturer for a period of five (5) years from the date of final inspection and acceptance. The warranty shall be included in the contract documents and shall include all parts labor (including travel), expenses and equipment necessary to perform replacement and or repairs.

1.5 SUBMITTALS:

A. Bidder shall submit the following information with bid.

1. Manufacturer and model number of proposed equipment.
2. Itemized list of equipment being bid.
3. Dimensions and weights.
4. Complete catalog information.

5. Any proposed deviation from the specification.

B. Shop Drawings: Drawings, details, and instructions necessary for installation of the generating unit shall be submitted for approval prior to the purchase of any equipment. The Contractor shall provide the following certified drawings:

1. Manufacturer's general outline drawings and installation drawings for all equipment furnished.

2. Complete elementary diagrams for electrical equipment and associated apparatus including 3-line diagram of primary connections, schematic diagram of all potential device terminals and internal device diagrams.

3. Schematic diagrams of all control and alarm circuits.

4. Complete wiring diagrams of equipment showing connections of all component devices and equipment.

C. Instructions and Manuals: The contractor shall furnish operating and maintenance instructions and manuals as follows:

1. Operating instructions for use by operating personnel shall be provided for each switch, framed under glass, and placed on or adjacent to equipment, where directed. These instructions shall include, but not be limited to, start-up, adjustment, operation, shut-down, safety precautions, procedure in event of equipment failure, etc.

2. Five copies of the Operating Technician's Manual shall be furnished to the Owner. Each manual shall be an assembly of the manufacturers' equipment instruction booklets, and in addition shall include (but not be limited to) the following: Detailed description of the functions of each principal component; procedure for starting, operating and securing the equipment; installation instructions; adjustment, maintenance and overhaul schedule procedure; test procedure; parts list, etc. The information contained in the manuals shall be comprehensive and specific in character and not general.

3. Manufacturer's recommended parts lists of the equipment being furnished, with prices, shall be submitted to the Engineer as soon as possible after the award of the contract.

1.6 OWNER INSTRUCTION:

A. Instruct Owner in all aspects of the operation, maintenance and trouble shooting of automatic transfer switches as part of the instructional period specified for engine generator set.

PART 2 - PRODUCTS:

2.1 MANUFACTURER:

A. Equipment products by ASCO, Caterpillar, Zenith, Cummins, or Russell Electric are acceptable subject to the conditions stipulated.

2.2 LUGS:

A. Provide compression, barrel, type lugs, sized as required for cables specified on drawings, for each power connection to the transfer switch to fit all incoming and outgoing cables.

B. Product specified here shall be UL listed for connection to conductors rated 75°C or higher.

2.3 FAULT CLOSING AND WITHSTAND RATINGS:

A. Equipment specified under this section shall have the following fault duty ratings when used with any UL Listed circuit breaker with fault rating equal or higher than that of the switch:

1.	Switch Rating (amperes)	3-Cycle Closing and Withstand Ratings for use With Overcurrent Protecting Device
2.	100A and smaller	42,000 (Provide in-line current limiting fuses if so required to accomplish this value)
3.	100A through 1200A	65,000

B. Provide oversized switches to accomplish specified fault rating if so required.

2.4 INTERFACE TO BUILDING AUTOMATION SYSTEM:

A. The electrical equipment specified under this section will be monitored by the building automation system (BAS). Provide assistance and coordination to facilitate the connection of this equipment to BAS as part of work under Division 25, Section 250900.

B. Monitoring shall be by dry contacts that shall be provided with the equipment.

C. Provide dry contacts for the following notifications:

1. Status: Switch is in normal position.
   Switch transferred to standby position.

2. Alarm: Switch lost normal power

D. Installation:

1. As part of the equipment manufacturer's installation and commissioning services, a factory authorized field engineer familiar with the communication interface will be present to assist the customer or the customer's designated representative in verifying that the communication interface to the building automation system is functional.

2. Any re-cabling, terminations, or re-programming required to make the interface 100% functional will be at the expense of the equipment manufacturer.

3. Any programming to make any dry contacts functional will be provided by the equipment manufacturer.

4. The equipment manufacturer will provide a factory authorized field engineer to assist the customer or the customer's designated representative in verifying that the alarms and statuses are functioning properly.

E. Submittals:

1. As part of the equipment drawing submittals, the equipment manufacturer will provide a drawing that clearly indicates the termination points for BAS interface communications. If the manufacturer requires a gateway or converter, the drawings will also include drawing(s) that clearly identify dimensions, mounting requirements, power requirements and interconnections for the converters or gateway.

2.5 AUTOMATIC TRANSFER SWITCH:

A. The transfer switch shall be double throw, 4-pole, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Minimum transfer time shall be 400 milliseconds. The transfer switch shall be rigidly constructed to close into and withstand the bolted fault current available at the switch.

B. The normal and standby contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and standby positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.

C. The transfer switch shall be equipped with a safe external manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly. The external manual operator shall be safely operated from outside of the transfer switch enclosure while the enclosure door is closed.

D. Provide one switch with 7-day automatic generator exercising with schedule adjustment.

E. Provide components required to continuously monitor the integrity of the remote start circuit(s) between the generator(s) and transfer switch(s). Loss of integrity of the control wiring shall initiate visual and audible annunciation of generator malfunction at local and remote annunciators.

F. Automatic Transfer Switch Controls:

1. The transfer switch shall be equipped with a microprocessor-based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with NiCad battery back-up. Provide potential and current transformers as required to show voltage

and amperes on sensing lines.

2. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit.

3. The controller shall use industry standard open architecture communication protocol for high-speed serial communications via multidrop connection to other controllers and to a master terminal with up to 4000 ft of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible.

4. The serial communication port shall allow in the future, if so desired, interface with owner's furnished remote supervisory control.

5. The controller shall have password protection required to limit access to qualified and authorized personnel.

6. The controller shall include a 20-character, LCD display, with a keypad, which allows access to the system.

7. The controller shall include three phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and standby sources. In addition, the controller shall show digitally voltage and ampere readings on monitored phases on both normal and standby sources.

8. The controller shall be capable of storing the following records in memory for access either locally or remotely:

    a. Number of hours transfer switch is in the standby position (total since record reset).
    b. Number of hours standby power is available (total since record reset).
    c. Total transfer in either direction (total since record reset).
    d. Date, time, and description of the last four source failures.
    e. Date of the last exercise period.
    f. Date of record reset.

9. The control module and the transfer switch shall be physically separated.

G. Sequence of Operation:

1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-9999 seconds factory set at 2 seconds to allow for momentary dips, the engine starting contacts shall close to start the engine generator set.

2. The transfer switch shall transfer to standby when the generating plant has reached specified voltage and frequency on all phases.

3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-9999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If the standby power source should fail during this time delay period, the switch shall automatically return to the normal source.

4. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-9999 seconds, factory set at 300 seconds.

H. Automatic Transfer Switch (Accessories to be Included):

1. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.

2. Programmable three phase sensing of the standby source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20%, and phase sequence monitoring.

3. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 2 second, if not otherwise specified.

4. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.

5. Time delay on transfer to standby, programmable 0-9999 seconds, factory set at 0 seconds for standby switch after generator set power is stabilized and 5 seconds for optional standby switch.

6. Time delay to control contact transition (neutral transition delay) adjustable 0-30 seconds. This is only required for optional standby power switches set at 3 seconds in both directions.

7. A maintained type of load test switch shall be included to simulate a normal power failure, keypad initiated.

8. A time delay bypass on retransfer to normal shall be included. Keypad initiated.

9. Contact rated 10 Amps 30VDC, to close on failure of normal source to initiate engine starting.

10. Contact rated 10 Amps 30VDC, to open on failure of normal source for customer functions.

11. Indicator lights shall be LED type. A test switch for testing the lights shall be provided.

12. Light emitting diodes shall be mounted on the microprocessor panel to indicate switch is in normal position, switch is in standby position and controller is running.

13. Provision to select either “no commit” or “commit” to transfer operation in the event of a normal power failure shall be included. In the “no commit position,” the load will transfer to the standby position unless normal power returns before the standby source has reached 90% of its rated values (switch will remain in normal). In the “commit position” the load will transfer to the standby position after any normal power failure. Keypad initiated.

14. Two auxiliary contacts rated 10 Amp, 120 volts AC (for switches 100 to 800 amps) 15-amp, 120 volts AC (for switches 1000 to 4000 amps), shall be mounted on the main shaft, one closed on normal, the other closed on standby. Both contacts will be wired to a terminal strip for ease of customer connections.

15. A three-phase digital LCD voltage readout, with 1% accuracy shall display all three separate phases to phase voltages simultaneously, for both the normal and standby source.

16. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and standby source.

17. An LCD readout shall display normal source and standby source availability.

18. (2) Form “C” contacts that open simultaneously before transfer in either direction and re-close instantaneously after transfer.

19. (2) Form “C” contacts that open simultaneously 5 seconds before transfer in either direction and re-close 5 seconds after transfer.

PART 3 - EXECUTION

3.1 SUPERVISION:

A. As part of this section, provide manufacturers’ trained field engineers or technicians for the following:

1. Supervision of installation of automatic transfer switches.
2. Start-up and calibration of time delay relays.
3. Performance tests in coordination with generator set tests.

4. Setting transfer delay timers as directed by engineer.

B. The manufacturer field service shall be available 24 hours a day, 365 days a year, on an on-call basis.

3.2 TEST:

A. Each automatic transfer switch shall be tested individually as a group in coordination with the testing of the new engine generator set. The cost of all fuel used on the test shall be paid for by this contractor. Demonstrate through testing performance of switch including the following operations:

1. Automatic operation, including command to start engine generator set.
2. Manual transfer operation
3. Bypass to normal, as applicable.
4. Bypass to standby, as applicable.
5. Test procedure: check timing of relays and adjust accordingly
6. Manual transfer procedure, as applicable

3.3 TEST REPORT:

A. Provide certified test report stating the tests performed and the successful completion of the tests.

3.4 NAMEPLATES:

A. Post diagrams, instructions and switching procedures on front of switches, as required by drawings and specifications, utilizing phenolic nameplates.

B. Refer to section 260529 for additional anchoring requirements.

C. Install equipment as per manufacturer's installation instructions.

D. Provide all the required work and materials for the installation including:

1. Uncrating equipment and transporting it from loading dock to designated installation location
2. Providing all necessary power, control and signaling wiring
3. Providing all the necessary building modifications to accomplish intended work
4. Assisting ATS manufacturer on testing of equipment and start-up
5. Providing Unistrut support, from floor to structure for switches that are designated for all mounting but are to be installed away from walls.
6. Make power cable connections to lugs utilizing appropriate hydraulic tools
7. Perform infrared inspection
8. Assist on the testing of the equipment

3.5 COMMISSIONING:

A. This contractor, and the manufacturers of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services, and support required by the project commissioning

agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 263214

SECTION 264100 - FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section includes requirements for providing a complete UL master labeled traditional lightning protection system for ordinary structures.

B. Related Requirements:

1. Refer to Section 260526, “Grounding and Bonding for Electrical Systems” for additional requirements related to grounding electrodes and connections.
2. Refer to Section 264300, “Surge Protection Devices” for additional requirements related to surge suppression.

1.3 REFERENCES

A. Abbreviations

1. LPI: Lightning Protection Institute
2. LPS: Lightning Protection System

B. Definitions

1. Grounding: Establishing a direct or indirect connection to Earth or some conducting body that serves in place of Earth.
2. Bonding: Method by which all non-energized conductive materials are effectively interconnected to create a low impedance path.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Fire Protection Association (NFPA)
    a. NFPA 780, Standard for the Installation of Lightning Protection Systems
2. Underwriters’ Laboratories (UL)
    a. UL 96, Standard for Lightning Protection Components

1.4 COORDINATION

A. Where the new lightning protection system connects to an existing lightning protection system with or without a UL master label, the new portion of the lightning protection system requires UL inspection and a Letter of Findings.

B. Coordinate system scope and layout requirements, attachment methods, and envelope penetrations with architectural roof plans, elevations, and sections.

1.5 PREINSTALLATION MEETINGS

A. Schedule preconstruction conference with Architect, Owner, and all affected trades. Agenda topics should include, but are not limited to, the following:

1. System Installation Schedule.
2. Planned down conductor routing.
3. Planned building enclosure penetrations.
4. Building material compatibility.
5. Cutting and patching requirements.
6. Surge protection requirements.

1.6 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional responsible for their preparation.

1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
2. Include raceway locations needed for the installation of conductors.
3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
4. Include roof attachment and penetration details, coordinated with roof installation warranty.
5. Calculations required by NFPA 780 for bonding of metal bodies.

C. Delegated Design: For system layout, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional responsible for their preparation.

D. Qualification Data: For Installer.

E. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

F. Sample Warranty.

G. Closeout Submittals

1. Operation and Maintenance Data: For lightning protection system to include in maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 “General Requirements for Electrical Systems” include the following:
    a. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.
3. As-Built Data: Dimensioned site plan showing dimensioned route of the grounding electrodes.

H. Completion Certificate:

1. UL Master Label Certificate suitable for fastening to building for display.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Regularly engaged in manufacturer of lightning protection equipment, of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than 5 years. The firm shall be a member of and certified by the Lighting Protection Institute.

B. Installer Qualifications: A firm with at least 3 years of successful installation experience on projects with lightning protection work similar to that required for project

1. The System Design shall be completed and the shop drawing stamped by an LPI Certified Master Installer – Designer of Lightning Protection Systems.
2. The installing contractor shall be listed with the Lightning Protection Institute, and Underwriters’ Laboratories, Inc.
3. The installation contractor shall have personnel on staff Certified by the LPI as a Master Installer – Designer of lightning protection systems.
4. LPI qualified staff, Journeyman or higher, shall provide on-site supervision of the installation.

1.8 WARRANTY

A. Furnish a 10-year adhesion warranty for all adhesives.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products from one of the following:

1. East Coast Lightning Protection
2. Harger
3. nVent Erico
4. Thompson Lightning Protection

5. VFC/Lyncole

B. Source Limitations: Obtain components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class I materials on structures not exceeding 75ft and Class II materials on structures or portions of structures exceeding 75ft.

B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency suitable to the Authority Having Jurisdiction as complying with UL 96, and marked for intended location and application.

C. Surge Suppression products for the electrical service entrance and communication services shall comply with NFPA 780 and UL 1449

2.3 MATERIALS

A. Comply with minimum Class I and Class II material requirements as listed in NFPA 780.

B. Air Terminals:

1. Aluminum unless otherwise required due to adjacent materials or existing conditions.
2. Safety tip.
3. Threaded base support: Adhesive type for membrane roof, non-penetrating clamp for standing seam metal roof.

C. Main and Secondary Conductors:

1. Aluminum unless otherwise required due to adjacent materials or existing conditions.
2. Smooth weave cable for Class I materials and Concentric or Ropelay for Class II materials
3. Cable Fastener: Adhesive type for membrane roof, non-penetrating clamp for standing seam metal roof.

D. Underground Conductors: Tinned copper.

E. Ground Rods:

1. Material: Copper-clad steel.
2. Diameter: 3/4 inch.
3. Rods: not less than 120 inches long.

F. Conductor Splices and Connectors for aboveground applications:

1. Suitable configuration and class type for the intended application and of the same material as the conductors or of electrolytically compatible materials

G. Adhesives: High performance, solvent free, UV resistant, for durable bond with substrate. All adhesives must be compatible with the roofing material and approved by the roofing system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections without excessive splices. Maintain a horizontal or downward route along the entire path to ground. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.

C. Rigidly fasten exposed conductors at intervals not exceeding 3 feet.

D. Conceal conductors within normal view from exterior locations at grade within 200 feet of building. Comply with requirements for concealed systems in NFPA 780.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid bars and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Structural elements and design features shall be used whenever possible to minimize the visual impact of exposed conductors.
4. Coordinate sequence of installation with other trades to avoid coring, cutting, and patching.
5. Do not install conductors in gutters, downspouts, or on surfaces where water is retained.

E. Where conductors are exposed to potential damage or environmental hazards at grade level, provide guards to protect the conductors to a point 10 feet above grade. Bond down conductors to guards or conduit at both ends.

F. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

G. Provide Ground Ring Electrode for structures exceeding 60 feet. The conductor shall not be less than the main-size lightning conductor.

H. Where local conditions such as soil material, earth resistivity, or limited project boundary require the use of other grounding electrode configurations, refer to grounding electrode requirements in Section 260526, “Grounding and Bonding for Electrical Systems”.

I. Provide bonding between the LPS grounding electrode system and the Building grounding electrode system in accordance with NEC and NFPA 780 requirements.

J. Install surge suppression at all power service entrances and at all entrances of conductive communications systems.

K. Provide cutting and patch as necessary for installation of work in existing structures. Refer to Section 260500, “Common Work Results for Electrical Systems”.

3.2 CONNECTIONS

A. All connections to down conductors and connections in earth or concrete: Exothermic weld.

B. Aboveground concealed connections: Exothermic welds or high-compression fittings listed for the purpose.

C. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: bolted connectors, exothermic weld, high compression, or crimp type.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

E. Follow manufacturer’s temperature and substrate requirements for installation of adhesives.

3.3 CORROSION PROTECTION

A. Coordinate lightning protection materials with building materials to assure compatibility.

B. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

C. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

D. Provide bimetallic connectors and fittings for splicing or bonding dissimilar metals.

E. Do not install aluminum materials in the following locations:

1. Embedded in or in direct contact with concrete, masonry, limestone, plaster, or mortar.
2. On copper surfaces or in locations exposed to direct water run-off from copper surfaces.
3. On a building surface coated with alkaline based paint.
4. In direct contact with earth or within 18-inches of the point where a conductor comes into contact with the earth.

F. Do not install copper materials in the following locations:

1. On aluminum surfaces or on exterior sheet metal surfaces.

3.4 FIELD QUALITY CONTROL

A. Testing: Upon completion of installation of lightning protection system, test resistance-to-ground with resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods.

B. Engage a third-party inspector to perform inspections required to obtain a UL Master Label for the system.

C. Prepare detailed test and inspection reports with corresponding test results and photos.

END OF SECTION 264100

SECTION 264300 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01 Specification sections apply to this section.

1.2 DESCRIPTION:

A. Provide surge protective devices (SPD) for the protection of all AC electrical circuits and electronic equipment from the effects of lightning induced voltages, external switching transients and internally generated switching transients.

1.3 REFERENCE STANDARDS AND PUBLICATIONS:

A. General: The latest edition of the following standards and publications shall comply to the work of this section:

1. ANSI/IEEE C62.41.1-2002, IEEE Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
2. ANSI/IEEE C62.45-2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000VC and less) AC Power Circuits.
3. Underwriters Laboratories UL 1449 Fourth Edition, Standard Surge Protective Devices
4. Underwriters Laboratories, UL 1283, Standard for Electromagnetic Interference Filters
5. National Fire Protection Association, NFPA 20, 70, 75 and 780
6. IEEE Standard 1100-2005, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book)
7. ISO 9001:2015, Quality Management Systems - Requirements.
8. In addition, the surge suppression system shall be rated for “Lightning” surges in accordance with UL master label requirements for lightning protection systems.

1.4 MANUFACTURER QUALIFICATIONS:

A. Products from Raycap, ABB/Current Technology, Eaton, Square D/Schneider or GE are acceptable if they meet this specification.

B. The manufacturer shall submit a written statement indicating that a factory authorized representative inspected the installation. The installing contractor shall submit a checkout memorandum to the manufacturer. The memorandum shall indicate the date the equipment is placed into service and the actual method of installation. Submit three copies to the specifying engineer.

C. All surge protective devices for service entrance, distribution, and branch circuit protection within a facility shall be provided by a single manufacturer.

D. The manufacturer must be regularly engaged in the manufacture of surge suppression products for the specified categories for no less than ten (10) years.

1.5 QUALITY ASSURANCE:

A. In case of conflict between this specification and UL Standard 1449 Fourth Edition, the requirements of UL Standard 1449 Fourth Edition shall prevail.

1.6 WARRANTY:

A. The SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of ten (10) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Any additional diagnostic circuits (LEDs, surge counter, etc.) must meet a warranty period of ten (10) years.

B. An SPD that shows evidence of failure or incorrect operation during the warranty period shall be replaced free of charge. Since “Acts of Nature” or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. That is, the warranty is to cover the effects of lightning, single phasing, and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

C. The installation of SPDs in or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.

1.7 SUBMITTALS

A. The surge protection device submittals shall include, but shall not be limited to, the following information:
   1. Data for each suppressor type indicating conductor sizes, conductor types, and connection configuration and lead lengths.
   2. Manufacturer’s certified test data indicating the ability of the product to meet or exceed requirements of this specification.
   3. Drawings, with dimensions, indicating SPD mounting arrangement and lead length configuration, and mounting arrangement of any optional remote diagnostic equipment and assemblies.
   4. List and detail all protection systems such as fuses, disconnecting means and protective materials.
   5. SPD wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

6. If requested, a sample of each suppressor type shall be submitted for use in testing and evaluation.

PART 2 - PRODUCTS

2.1 PERFORMANCE

A. SPDs shall be UL listed.

B. The SPD shall protect all modes and there shall be seven discrete suppression circuits: 3 modes connected Line to Ground, 3 modes connected Line to Neutral, and 1 mode connected Neutral to Ground for a 3-phase, 4-wire, plus ground voltage system. Line to Neutral to Ground is not an acceptable substitute for Line to Ground. Line to Neutral to Line and Line to Ground to Line (in combination) will be acceptable for Line to Line protection.

C. SPDs shall use a separate path to building ground; the equipment safety ground is not to be used as a transient ground path.

D. All SPDs are to be MOV based.

E. The maximum continuous operating voltage (MCOV) of all components shall not be less than 115% of the nominal system voltage.

F. Standard diagnostic features are to include green LEDs (one per phase - normally on) indicating power and suppression status

G. Form-C rated relay contact

H. Extended diagnostics must include an audible alarm and surge counter to be displayed on an LCD display on the front of the suppressor. The surge counter must include a reset option as well as time & date stamp and onboard event log. The audible alarm must include a mute option. Products requiring diagnostic test kits will not be acceptable.

2.2 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSORS

A. The SPD shall meet or exceed the minimum performance criteria as follows:

1. The single-impulse surge-current rating shall be a minimum of 300,000 Amperes per phase (150,000 Amperes per mode).
2. The UL Voltage Protection Ratings for the following configurations shall not exceed the following:

Voltage Configuration	L-N	L-G	L_L
120/208V	700V	700V	900V
277/480V	1200V	1200V	2000V

3. SPDs shall be of compact design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and the point of connection in the panelboard.
4. Visual indication of proper SPD connection and operation shall be easily viewed on the front panel of the enclosure. The indicator lights shall indicate suppression circuit status, phase status, phase loss, reduced protection level and suppression fault.
5. The SPD shall be equipped with an integral disconnect switch or be available as an option.
6. The SPD shall be equipped with a surge counter with time and date stamp and onboard event log.
7. A set of normally open/normally closed Form "C" dry contacts shall be provided for remote monitoring.
8. The enclosure type shall be suitable for the environment.
9. SPDs shall be equipped with an audible alarm with mute, reset and acknowledge features.
10. The maximum value for the attenuation for the suppressor must exceed a minimum of 33 dB. The test shall be performed with only six (6) inches of lead length extending outside of the normal exit location of leads for the enclosure. Test results taken with leads extending past six (6) inches are not acceptable or compliant. Additional or excessive lead length used in the test setup is NOT acceptable.

2.3 PANEL SUPPRESSORS

A. The panel SPD equipment shall meet or exceed the minimum performance criteria as follows:

1. The single-impulse surge-current rating shall be a minimum 100,000 Amperes per phase (50,000 Amperes per mode).
2. The UL Voltage Protection Ratings for the following configurations shall not exceed the following:

Voltage Configuration	L-N	L-G	N-G
120/208V	700V	700V	700V
277/480V	1200V	1200V	1200V

3. SPDs shall be of compact design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and the point of connection in the panelboard.
4. Visual indication of proper SPD connection and operation shall be easily viewed on the front panel of the enclosure.
5. The indicator lights shall indicate suppression circuit status, phase status, phase loss, reduced protection level and suppression fault.
6. The SPD shall be equipped with an integral disconnect switch or be available as an option.
7. A set of normally open/normally closed Form "C" dry contacts shall be provided for remote monitoring.
8. The enclosure type shall be suitable for the environment.

9. SPDs shall be equipped with an audible alarm with mute, reset and acknowledge features.
10. The maximum value for the attenuation for the suppressor must exceed a minimum of 33 dB. The test shall be performed with only six (6) inches of lead length extending outside of the normal exit location of leads for the enclosure. Test results taken with leads extending past six (6) inches are not acceptable or compliant. Additional or excessive lead length used in the test setup is NOT acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installing contractor shall install the parallel SPD with short and straight conductors as practically possible.

B. The contractor shall follow the SPD manufacturer's recommended installation practice as found in the equipment installation instructions.

C. The installation shall apply to all applicable codes.

END OF SECTION 264300

SECTION 265000 - BUILDING LUMINAIRES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior solid-state luminaires that use LED technology.
   2. Lighting fixture supports.

B. Related Sections:
   1. Section 262726 – Wiring Devices
   2. Section 265400 – Occupancy Sensor Lighting Control Systems

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 SUBMITTALS

A. Shop drawings, product data, assembly drawings, wiring diagrams, performance, maintenance data, etc. shall be submitted in accordance with the provisions of specification Section 260100

B. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

6. Photometric data and adjustment factors based on laboratory tests.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

C. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

D. Product Schedule: Refer to drawings for luminaires and lamps.

E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved, as applicable:
1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Ceiling-mounted projectors.
7. Moldings.

F. Qualification Data: For testing laboratory providing photometric data for luminaires.

G. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Product Certificates: For each type of luminaire.

I. Sample warranty.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty for products specified here shall be in accordance with the requirements stated in the General Condition and Supplementary Conditions of the Contract.

C. Special Warranties: Manufacturer's standard form in which manufacturer of specified lighting unit agrees to repair or replace components of such lighting unit that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining 4 years.
   2. Warranty period for LED Lighting Fixtures: Manufacturer and luminaire distributor agree to repair or replace LED luminaires that fail during the warranty period as qualified here:
      a. The requested warranty for LED array and driver is a full 7-year warranty for parts and labor from the date of substantial completion.
      b. Warranty for fixture paint, lens, de-coloration, or corrosion is three years from the date of substantial completion.
      c. The warranty for LED luminaires is a full warranty. The warranty is for an installation as defined by the Contract Documents for this specific building.
      d. The method of switching used for the LED luminaires shall not reduce in any way the required 7-year warranty. The switching method is as shown on the drawings.

PART 2 - PRODUCTS

2.1 LUMINAIRE 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.

B. Standards:
   1. ENERGY STAR certified.
   2. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
   3. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
   4. UL Listing: Listed for damp location.
   5. Recessed luminaires shall comply with NEMA LE 4.
   6. User Replaceable Lamps:
      a. Bulb shape complying with ANSI C78.79.
      b. Lamp base complying with ANSI C81.61.

C. CRI of minimum 70. CCT of 3000 K or 4100 K, as indicated on drawings.

D. Rated lamp life of 50,000 hours to L70.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: 120V to 277V, as indicated on drawings.
   1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

H. Housings:
   1. Extruded-aluminum housing and heat sink.
   2. Finish, as indicated on drawings.

2.2 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

C. Diffusers and Globes:
   1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Glass: Annealed crystal glass unless otherwise indicated.
   3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage, and coating.
      c. CCT and CRI for all luminaires.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with State of Virginia requirements.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
   2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.
      c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
      d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
      f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
      g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

3. Master/Remote Sign Configurations:
   a. Master Unit: Comply with requirements above for self-powered exit signs and provide additional capacity in battery for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529- "Supports and Fasteners" for channel- and angle-iron supports, and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

B. Lighting Fixtures
   1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
   2. Install lamps in each luminaire.

C. Temporary Lighting: If it is necessary, and approved by Owner's Representative, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

D. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

E. Lay-in Ceiling Lighting Fixtures Supports:
   1. Where a lighting fixture replaces ceiling tile in lay-in ceilings, support fixture with minimum of two support wires, one at opposite corner of fixture and secure fixture to ceiling grid main runners with sheet metal screw at each corner of the fixture. It is the responsibility of the Division 26 Contractor to arrange with the ceiling installer for the proper location of ceiling grid main runners to accomplish fixture attachments.
   2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   3. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have a breaking strength of the weight of fixture at a safety factor of 3.

F. Suspended Lighting Fixture Support
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
   4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Connect wiring according to Section 260519 – “Conductors”.

H. Identification
   1. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 – “Nameplates and Signs.”

3.2 FIELD QUALITY CONTROL

A. Start-Up Service
   1. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by the Owner. Burn-in LED lights and fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

B. Adjusting
   1. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this Work may be required after dark.
      a. Adjust aimable luminaires in the presence of Owner’s Representative.

END OF SECTION 265000

SECTION 265400 – OCCUPANCY SENSOR LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.2 EQUIPMENT QUALIFICATION:

A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be UL listed.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

E. Occupancy sensor lighting control system shall be fully compatible with the ballasts of lighting fixtures specified and submitted.

F. Occupancy sensors that provide automatic switching functions based on "smart" technology incorporating "learning" features are not allowed in this project.

1.3 SYSTEM DESCRIPTION:

A. Provide occupancy sensor-based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area and lighting is automatically turned back on when a person enters the room.

B. The occupancy sensor-based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance with this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective, or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on both equipment and labor shall be for a minimum period of five (5) years.

D. The spaces where automatic control of the lighting is required is shown on drawings by using symbols depicting occupancy sensor or sensors. Provided the quantity of sensors in each space that is required to accomplish full coverage of the space regardless of quantity of sensors shown on drawings.

1.4 SUBMITTALS:

A. Contractor through the manufacturer of the equipment shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan at scale 1/8" = 1'-0", or larger, clearly marked by manufacturer showing proper product, location, and orientation of each sensor. For typical spaces, like small offices, a typical plan drawing will be sufficient for classrooms and other spaces submit specific plan drawings identifying each space with room number.

C. Submit any interconnection diagrams per major subsystem showing proper wiring.

D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts. However, it is the contractor and supplier responsibility to provide all supplementary relays circuits and wiring to make system work as intended.

1.5 SYSTEM OPERATION:

A. Factory Startup:
   1. It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service shall be provided as par of work under this section.

1.6 POST INSTALLATION RECORD DRAWINGS:

A. Submit, after completing satisfactorily all field adjustments, a set of revised shop drawing plans indicating final location of sensors, area controlled by sensor, sensor orientation and control relays. In addition, the drawings shall indicate the orientation of each sensor and its sensitivity and time delay setting. Include current room numbers and names for each space where an occupancy sensor is located. Include final control wiring diagrams of installations where auxiliary control relays have been used to accomplish lighting control. The drawings shall be sealed, signed, certified, and dated by the factory technician that accomplished the work and by the electrical contractor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received, and submittals made are for sensors which meet or exceed the specifications included herein.
   1. B.E.G.
   2. Watt-Stopper
   3. Leviton
   4. Hubbell
   5. Lutron

2.2 DUAL TECHNOLOGY OCCUPANCY SENSOR:

A. Dual Technology sensors shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.

B. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur to activate lighting systems. Upon verification, detection by either shall hold lighting on.

C. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

D. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

E. Detection shall be maintained when a person of average size and weight moves only within or a maximum distance of 12 inches either in a horizontal or vertical manner at the approximate speed of 12 inches per second. The sum of this distance, volume and speed represents the average condition a dual technology sensor must meet for the lights to remain on when a person is reading or writing while seated at a desk.

F. Sensor shall be capable of corner mounting to a wall or ceiling to eliminate detection through open doorways and outside of controlled area. To provide superior small motion detection and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.

G. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

H. Sensor shall utilize mixed signal ASIC (application-specific integrated circuit) technology, which combines analog and digital processing into one chip package, to provide immunity to RFI and EMI.

I. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

J. To ensure high sensitivity to small motion at the desktop, the standard lens shall be 30 elements with 15 layers horizontally and 4 layers vertically and shall cover up to 2000 square feet for walking motion when mounted at a ceiling height of 10 feet.

K. For accuracy, sensor shall have a DIP switch controlled, digital time delay of 30 seconds to 30 minutes. Set at 10 minutes.

L. Sensor shall have a DIP switch override-ON function for use in the event of a failure.

M. Each sensing technology shall have an independent sensitivity adjustment and LED indicator that always remains active in order to verify detection within the area to be controlled.

N. Sensor shall incorporate field-selectable logic configurations which allows for space utilization changes and/or other special field conditions.

O. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

P. Sensor shall have standard 5-year warranty and shall be UL and CUL listed.

2.3 POWER SUPPLIES AND AUXILIARY RELAY MODULES:

A. Provide 120 and 277 volts A.C. to 24 VDC power supplies (“Power Packs”) and auxiliary relay modules (“Slave Packs”) as required to make occupancy sensor lighting control system operational.

B. Power packs consist of a transformer and high-current relay combined in one small, powerful package. The transformer of the power packs has a primary high voltage input of 120 or 277 volts, as applicable and a secondary 24VDC, 150 mA output. The secondary voltage provides

operating power to the occupancy sensors. When the occupancy sensors detect motion, they electrically close an internal circuit which sends 24 VDC back to the power or slave packs which control the lighting systems.

C. Power packs shall have the following characteristics:
   1. Secondary output of 150 mA.
   2. UL rated 94 V-0 plastic enclosure; units are white.
   3. Low voltage leads rated for 300 volts.
   4. Size: 1.6” x 2.75” x 1.6” (41mm x 70mm x 41mm) with a ½ inch snap-in nipple
   5. UL and CUL listing

D. Slave Packs: shall be like power packs except without power supply.

E. Both power packs and slave packs shall be suitable for installation in air plenum above ceiling spaces.

PART 3 - EXECUTION

3.1 CONTROL WIRING:

A. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded UL Classified, CMP, TEFLON jacketed cable suitable for use in plenums, where applicable.

B. Minimum acceptable wire gauge from the circuit control hardware relays shall be #12 AWG. All 120 volts or 277 volts wiring shall be run-in conduit.

3.2 INSTALLATION:

A. It shall be the contractor’s responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer’s recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to cover the respective room properly and completely.

B. It is the contractor’s responsibility to arrange a pre-installation meeting with the manufacturer’s factory authorized representative, at the owner’s facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

D. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

E. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

3.3 SENSOR DELAY SETTINGS:

A. Set sensors to turn off lights after the following delay upon sensing the absence of occupants in the space (verify settings with Owner prior to setting delays).

Conference Rooms	15 Minutes
Laboratories	20 Minutes
Corridors	20 Minutes
Group Offices	15 Minutes
Lobbies	20 Minutes
Break Room	15 Minutes
Private Offices	10 Minutes
Toilets	30 Minutes

B. Refer to Part 1 – General for required post-installation submittal.

END OF SECTION 265400

SECTION 269000 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RECORD DRAWINGS:

A. The Electrical contractor shall keep a record copy of the bid set and fabrication drawings at the job site and shall accurately maintain a record with dimensions and elevations of all changes to the contract drawings as the job progresses. At the completion of the job, the electrical contractor shall obtain a sepia reproducible from the Architect and shall make changes which occurred during construction on drawings and submit three (3) copies to the Engineer. The Engineer will check drawings and will return them to contractor with comments or statement of approval, as applicable.

1.2 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEMS:

A. After installation has been completed, equipment has been tested, systems placed in permanent operation, and all adjustments made, a competent start-up technician shall be provided for a period of two working days. This technician shall operate the systems during this time, and during this time shall instruct the Owner's designated representatives in the operation and maintenance of the equipment. The start-up technician shall be at the site continuously during working hours during the instructional period.

B. Operating and Maintenance Manuals:
   1. The form in which the operating maintenance manual is to be presented shall be subject to approval by the Architect.

C. The following items, together with any other necessary and pertinent data, shall be included in the manual. This list is not necessarily complete and is only to be used as a guide.
   1. Settings of all control and switches for normal operation with description of control and its location.
   2. A check list for periodic maintenance of all equipment, with maintenance and cleaning instructions.
   3. As built wiring diagrams, interlock, and control diagrams for the equipment.
   4. Parts list for all replaceable service parts and indicate where they may be purchased.
   5. Manufacturer's cuts and rating tables for all equipment, including copies of all factory record drawings and all other shop drawings.
   6. Test data on all equipment.
   7. Serial numbers of all principal pieces of equipment.
   8. Manufacturers', suppliers, and subcontractors' names, addresses, and telephone numbers.
      a. The first page shall identify project and give name, address and phone number of Architect, Engineer, Mechanical and Electrical sub-contractors, and any service companies involved and give name and night phone of each party representing the electrical contractor responsible for service during warranty period.

1.3 WARRANTIES:

A. Deliver to Owner all warranties, guarantees, etc. and obtain written receipts.

1.4 PUNCH LIST:

A. During construction period the A/E will issue punch lists. These items shall be completed before A/E will approve next application for payment. Final punch list work shall be completed before acceptance.

1.5 FINAL INSPECTION AND ACCEPTANCE:

A. The architect or his authorized representative will entertain the request for final inspection and acceptance only after the following items are done.

B. Submit a list of uncompleted items, if any, and advise when the items will be done.

C. Complete all items on A/E's prefinal punch list.

1.6 FINAL CLEAN UP:

A. During construction this contractor shall keep the site clear of debris and upon completion of construction he shall clean up the premises and to remove all evidence of his work.

B. The contractor shall resolve all questionable items to be corrected prior to an inspection by the Engineer.

1.7 GUARANTEE:

A. The guarantee shall be as stated in the General Conditions, and the General Provisions of this section.

1.8 CLOSE-OUT CHECK LIST:

A. Provide, perform, and submit all the items included in the following close-out list.

Section	***Item***	***Action***
260100	Factory Record Drawings: . Fire Alarm . Lighting Controls . Panelboards	Submit
260100	Certificate of Inspection by Code Authority	Submit

Section	*Item*	*Action*
260100	Remove all debris and clean: . Light Fixtures . Electrical Rooms . Interior of Panels	Perform
260100	Operation and Maintenance Manuals	Provide
260100	Equipment Warranties	Submit
260100	Record Drawings	Submit
260100	Test Results & Certifications: . 600 Volt Cable Test	Perform/Submit
260530	Sealing of incoming conduit	Perform/Verify
260553	Nameplates	Provide/Verify
260943	Lighting Control System Settings and Tests	Perform
260574	Set trips of all adjustable overcurrent protection devices	Perform/Verify
260574	Post Arc Flash Hazard category, boundary and required protection	Perform/Verify
260943	Lighting Control System Personnel Instruction	Perform
263200	Generator set Personnel Instruction	Perform
263200	Generator Set Recommended Parts List and spare parts.	Provide
263200	Generator Set Documentation on Factory Authorized Field Service Center	Provide
263200	Generator Set Load Test	Perform & Submit Report
263200	Generator Set Test Report	Submit
263200	Fill Generator Tank with Fuel	Perform/Verify
263214	ATS Personnel Instruction	Perform
264300	SPD Test Reports	Submit
265000	Light Fixture Extra Lenses	Provide/Verify
265000	Clean Light Fixtures	Perform
265000	Replace Lamps Used for Construction Purposes	Perform/Verify
265400	Occupancy Sensor Lighting Control System Test and Commissioning	Perform/Verify/Submit

END OF SECTION 269000

SECTION 269990 - ALTERNATES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The electrical bidders shall include with their bid for Division 26 - Electrical work, their price for accomplishing work described under the alternates listed here.

B. Each alternate price listed by the Bidders shall cover all costs required for the part of work, complete in place, including all changes, alterations or modifications to surrounding work required to accommodate the substitution, addition, deletion or other change.

C. Material and construction methods required for each alternate shall, unless otherwise specifically stated, conform to applicable requirements of the specifications.

D. All alternates whether additive or deductive should include appropriate provisions for overhead and profit.

1.2 DESCRIPTION:

A. Refer to Division 01 - Section “Alternates” for a list of alternates.

B. The Base Bid shall be the price for the work, complete, as illustrated on the drawings and described in these specifications, except the work described in Alternates.

1.3 ALTERNATES:

A. Alternate No. 1: Provide permanent generator and associated equipment as indicated on the drawings.

B. Alternate No. 2: Provide lightning protection system for facility per Specification Section 264100.

END OF SECTION 269990