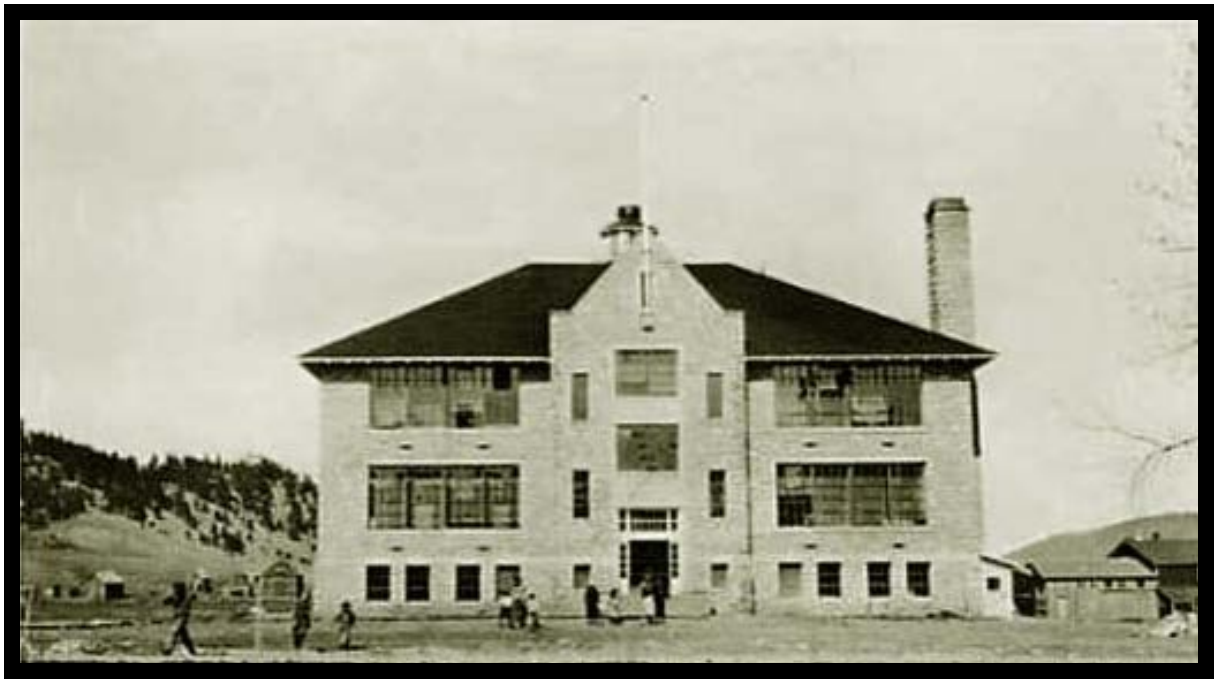
PROJECT MANUAL

OLD STONEY REMODEL
PHASE ONE



November 20, 2017

SET # _____

Stateline No. 7 Architects

TITLE PAGE

PROJECT:	OLD STONEY REMODEL – PHASE ONE 108 NORTH FOURTH STREET SUNDANCE, WYOMING 82729
OWNER:	CITY OF SUNDANCE 213 EAST MAIN STREET PO BOX 542 SUNDANCE, WYOMING 82729 CONTACT: KATHY LENZ, CLERK-TREASURER
DATE:	NOVEMBER 20, 2017
ARCHITECT:	STATELINE NO. 7 ARCHITECTS 444 SOUTH CENTER STREET CASPER, WYOMING 82601 (307) 265-3611 PRINCIPAL: LYLE T. MURTHA, AIA E-MAIL: lmurtha@stateline7.com
CIVIL ENGINEER:	INTERSTATE ENGINEERING 315 MAIN STREET PO BOX 828 SUNDANCE, WYOMING 82729 (307) 283-3675 CODY GALLOWAY, EIT E-MAIL: cody.galloway@interstateeng.com
STRUCTURAL ENGINEER:	MARTIN/MARTIN WYOMING, INC. PO BOX 1067 SUNDANCE, WYOMING 28729 (307) 283-3900 AMANDA MILLER, P.E. E-MAIL: amiller@mmwyo.com
MECHANICAL ENGINEER:	ENGINEERING DESIGN ASSOCIATES 1607 CY AVENUE, SUITE 303 CASPER, WYOMING 82604 (307) 266-5033 ANDREW ELSTON, P.E. E-MAIL: AElston@edaengineering.com

ELECTRICAL ENGINEER: ENGINEERING DESIGN ASSOCIATES
1607 CY AVENUE, SUITE 303
CASPER, WYOMING 82604
(307) 266-5033
MONTE N. SCHAFF, P.E.
E-MAIL: mschaff@edaengineering.com

I hereby certify that this specification together with the accompanying contract documents was prepared by me under my direct supervision and that I am a duly Registered Architect under the laws of Wyoming.

OLD STONEY REMODEL – PHASE ONE
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ADVERTISEMENT FOR BID

Plans will be available on November 20, 2017 for the project known as Old Stoney Remodel – Phase One, 108 North 4th Street, Sundance, Wyoming. Sealed bids will be received by the office of the owner of the project at the Sundance City Hall, 213 East Main Street, Sundance, Wyoming 82729 on Wednesday, December 20th, 2017 until 3:00 p.m. local time for labor and materials to construct the Old Stoney Remodel – Phase One, 108 North 4th Street, Sundance, Wyoming. The bid opening will be open to the public.

A single contract will be awarded for the Demolition, General, Civil, Structural, Architectural, Mechanical, and Electrical work as drawn and specified in the Plans and Specifications. Bid Security will be required. Performance and Labor and Material Payment Bonds in the amount of 100% of the contract will also be required. State of Wyoming 5% preference laws and the Wyoming Public Works and Contracts Act, W.S. 16-6-101 thru 16-6-121 apply. The estimated value of the construction is approximately $ 2,173,299.00. Interest from general contractors and subcontractors with historic building renovation experience is encouraged.

Copies of the Plans and Specifications may be reserved by bidders at the office of the Architects, Stateline No. 7 Architects, 444 South Center Street, Casper, Wyoming 82601, telephone number (307)-265-3611, attn: Lyle Murtha, AIA or Kelly Fox.

A mandatory pre-bid site visit for General Contractors will be conducted at 1:30 p.m. on November 30th 2017 at the project site, 108 North 4th Street, Sundance, Wyoming. Mechanical, electrical, carpenter/wood finishers and other major subcontractors are also encouraged to attend.

The project consists of the renovation of three floor levels of the existing historic 1924 post-and-beam, wood joist framed, cut stone load bearing masonry building with slab on grade and wood framed floors and spread (assumed rubble stone) footings. The existing building renovation area includes approximately 13,625 gross square feet and will be converted from a former vacant educational/school building into a museum and office rental spaces. The work includes miscellaneous demolition; excavation; backfill; irrigation; landscaping; grading; exterior concrete flatwork; trenching and underground site utilities; cast-in-place concrete; cast-in-place architectural concrete; flag pole; steel framing; misc. steel; exterior steel stair; wood doors and frames; aluminum storefront doors and windows; rigid and batt insulation; wood and metal framing; interior finish carpentry; sanding and refinishing existing wood floors, stairs, handrails and doors; interior and exterior painting and stain; powder coat finishing; re-finishing and re-glazing existing steel frame windows; gutters and downspouts; gypsum board; rubber base; floor and wall tile; toilet partitions and toilet accessories; high-density filing/storage system; solid surface countertops; electric roller window shades, freight elevator; plumbing and plumbing fixtures; fire protection system; HVAC equipment; fire alarm system; electrical wiring and interior and exterior fixtures; and other miscellaneous items.

Owner of the Project

City of Sundance, Wyoming
213 East Main Street
PO Box 542
Sundance, Wyoming 82729
Contact: Kathy Lenz, Clerk-Treasurer

Project

Old Stoney Remodel – Phase One
108 North 4th Street
Sundance, Wyoming 82729

INSTRUCTIONS TO BIDDERS

I. SUMMARY OF THE PROJECT:

The project consists of one prime contract for the construction and renovation of three floor levels of the existing historic 1924 post-and-beam, wood joist framed, cut stone load bearing masonry building with slab on grade and wood framed floors and spread (assumed rubble stone) footings located at 108 North 4th Street, Sundance, Wyoming. The existing building renovation area includes approximately 13,625 gross square feet. The project includes all Demolition, General, Civil, Structural, Mechanical, and Electrical work on the drawings and specified herein.

All other Owner furnished, Contractor installed (OFCI) items, as identified in the Plans and Specifications, will be coordinated as outlined in the Supplemental General Conditions.

II BIDDERS SITE VISIT:

A mandatory pre-bid site visit for General Contractors will be conducted at 1:30 p.m. on November 30th 2017 at the project site, 108 North 4th Street, Sundance, Wyoming. Mechanical, electrical, carpenter/wood finishers and other major subcontractors are also encouraged to attend. No extra compensation will be allowed for items and/or conditions that were present at the project site and should have been noted prior to bidding.

III CONTRACT DOCUMENTS:

The following constitute the Contract Documents that will be included as a part of the Contract and Bid Proposal:

Instructions to Bidders
Asbestos Statement
General Conditions
Supplemental General Conditions
Standard Form of Agreement Between Owner and Contractor – AIA Document A101
Standard General Conditions of the Construction Contract – AIA Document A201
Standard Supplementary Conditions
General Requirements - Division 1
Technical Specifications - Divisions 2 through 32
Addenda
Architectural Drawings prepared by Stateline No. 7 Architects
Civil Drawings prepared by Interstate Engineering
Structural Drawings prepared by Martin/Martin Wyoming, Inc.
Mechanical and Electrical Drawings prepared by Engineering Design Associates

IV INTERPRETATION OF CONTRACT DOCUMENTS:

If a person contemplating the submission of a Proposal for the proposed Contract is in doubt as to the meaning of any part of the Drawings and Project Manual, or other proposed contract documents, or should errors, omissions or discrepancies in or between Drawings and Specifications exist or appear to exist, he/she shall submit to the Architect a written request for interpretation or clarification thereof at least seven (7) days prior to the scheduled time for closing of bids. The person submitting the request shall be responsible for its prompt delivery. Any interpretation or clarification of the Contract

Documents shall be made in writing and by addendum duly issued, and a copy of such addendum will be available to all bidders. The Owner will not be responsible for any other explanation or interpretation of the Contract Documents. Receipt of addendum by Bidders shall be acknowledged on the Bid Proposal. No oral explanation or interpretations will be made or acknowledged by the Architect.

V SUB-HEADINGS AND TITLES:

The titles or sub-headings used in this Contract and in the Contract Documents are understood to be for convenience of reference only and shall not be taken or considered as being a part thereof, or as having any bearing on the interpretation thereof.

VI SUBSTITUTION OF MATERIALS:

Materials or products specified by trade name, manufacturer's name or catalog number shall be provided as specified. Substitutions will be permitted only by one of the following methods:

1. **Prior to the Award of the Contract, interested parties may request approval of substitute materials. Such request shall be made in writing on the Product Substitution Form included and delivered to the Architect no later than ten (10) days prior to receipt of bids. In order to establish a basis of quality, certain materials or articles are specified by designating one or more manufacturers' names, brands, or numbers. Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the architect, of equal substance, appearance and function. All substitutions approved will be listed in an Addendum.**

2. **If a material is specified by manufacturer's name and/or several manufacturers are listed, any of those mentioned will be considered as acceptable. The first name mentioned will be the product on which the Drawings are based, and space requirements and details are designed to work with the product. It shall be the responsibility of the Contractor to verify that the product he/she proposes meets all space and detail requirements.**

3. **If a material is specified herein stating "equal to" a manufacturer's product, then similar products of equal quality will be considered. It shall be the responsibility of the Contractor to submit proof, if required, of the product specified. If material herein specified states "prior approved equal", such material shall have written approval before bidding, in accordance with (1) above.**

4. **If a material is not mentioned by manufacturer's name, but only by technical characteristics, any product meeting these characteristics will be considered.**

Products covered by Paragraphs (3) and (4) above, if other than those named in the Specifications, shall be submitted for approval not more than thirty (30) days after award of Contract. If no submittal is made within the thirty-day time limit, the Contractor will be required to furnish the specified products. Proposals for substitutions shall be accompanied by complete data and samples.

VII OR EQUAL PHRASE:

Where the phrase "or equal" or "or equal as approved by the A/E" occurs in the Contract Documents, materials or methods will not be approved as equal by the Architect unless the item has been specifically done so in writing in accordance with VI, 3 above.

VIII AVAILABILITY OF SPECIFIED ITEMS:

Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work. In the event any specified item or items will not be so available, so notify the Architect prior to date of receipt of bids.

IX NOTIFICATION OF ACCEPTANCE OF BID PROPOSAL:

The Owner will, upon review and acceptance of Proof of Competency or if none required, after opening of bids, notify the successful Bidder of the acceptance of his Proposal (within 30 days).

X INDEMNITY:

The Contractor shall indemnify and save harmless the Owner from and against all losses and all claims, demands, payment, suits, actions, recoveries, and judgments of every nature and description brought or recovered against him, by reason of any negligent act or omission of the said Contractor, his agents or employees, in the execution of the Work or in the guarding of it and this shall include acts or omission of Subcontractor.

The Contractor shall, and is hereby required to, maintain such insurance, issued in the name of the Owner, as will protect the Owner from his contingent liability under this Contract, and the Owner's right to enforce against the Contractor any provision of this Section shall be contingent upon the full compliance by the Owner with the terms of applicable insurance policy or policies, a copy of which shall be deposited with the Owner.

XI CONTRACTOR LIABILITY INSURANCE:

The Contractor shall maintain insurance as will protect him from claims under Workmen's Compensation Acts and from any other claims for damages for personal injury, bodily injury, and property damage which may arise from the Contractor's acts or by any Subcontractor or anyone directly or indirectly employed by either of them.

XII CONTINUATION OF LIABILITY POLICIES:

Contractor shall maintain liability policies throughout the one-year project warranty period.

XIII INSURANCE CERTIFICATES:

Without limiting any of the other obligations or liabilities of the Contractor, the Contractor shall provide and maintain, until the Work is completed and accepted by the Owner, minimum insurance coverages in accordance with requirements herein provided for on AIA Document G715. Insurance must be written by a Best's rated company of B+ or better rating.

Copies of AIA Document G715 will be supplied by the Architect to the Contractor for completion by his insurance carrier or agent. The AIA Document G715 shall be sufficient in number to furnish: (1) Contractor and his insurance carrier or agent with their needs, and (2) two copies for the Owner.

The Contractor's insurance carrier or agents shall complete the Owner's copy of Certificates in sufficient time to allow for review and approval by the Owner's Attorneys prior to the actual start of the Work by the Contractor.

The Insurance Requirements AIA Document G715 will designate the party to receive the completed AIA Document G715, and this party will be responsible to see that such forms are received and approved by the Owner's Attorneys prior to commencement of any work under this Contract. He/she will also be responsible to see that renewal forms are submitted and approved if the Work is to extend beyond the expiration dates of coverages approved by the Owner's Attorneys.

Such insurance shall not be written for amounts less than the following:

Workmen's Compensation as required by all applicable Federal, State, or other laws including Employers' Liability with a limit of at least:	**$ 500,000**

Comprehensive General Liability all on the occurrence basis including:

Contractor's Liability
Contingent Liability
Contractual Liability
Completed Operations (kept in force for at least two years after date of final completion)
Products' Liability
Broad Form Property Damage
Remove XCU exclusions (explosion, collapse, underground property damage)

Total	**$ 1,000,000**

Personal Injury: Eliminate the exclusion for claims sustained by any person as a result of an offense directly or indirectly related to the employment of

such person

Each Occurrence	**$1,000,000**
Aggregate	**$1,000,000**

Bodily Injury:

Each Person	**$1,000,000**
Each Occurrence	**$1,000,000**

Property Damage:

Each Accident	**$1,000,000**
Aggregate	**$1,000,000**

Combination of underlaying Comprehensive Liability for lesser limits with remaining limits provided by Excess or Umbrella Liability

Comprehensive Automobile Liability including non-ownership and hired car coverage as well as owned vehicles:

Bodily Injury:

Each Person	**$1,000,000**
Each Occurrence	**$1,000,000**

Property Damage:

Each Occurrence	**$1,000,000**

Builders' Risk Insurance:

The Contractor will purchase permanent builders' risk insurance for the construction and renovations for the duration of the project.

It is a condition of the Contract that the policy or policies waive any and all governmental immunity as a defense in any action brought against the insured.

Approval of the insurance by the Owner shall not in any way relieve or decrease the liability of the Contractor hereunder and it is expressly understood that the Owner or the Architect does not in any way represent that the above required insurance or limits of liability are sufficient or adequate to protect the Contractor.

Evidence of the above required insurance shall be furnished only on AIA Document G715, "Certificate of Insurance," unless further verification of coverage is requested by the Owner.

It shall be the sole responsibility of the Contractor to maintain as minimum coverage, insurance on the Work against the perils of fire and extended coverage in an amount equal to the full value of the newly constructed property at risk (Builders' Risk Insurance). In addition, the Contractor shall be solely responsible for payment of any amounts which may become payable as a result of any co-insurance penalty, deductible provision, corridor, or self-insured retention provision of the policy or policies, as well as all losses arising out of any uninsured perils.

It is a condition of the Contract that the Owner, the Owner's Architect, and all Contractors, Subcontractors, and their corporate sureties waive all rights of recovery against each other for damages caused by fire or other perils to the extent such damages are covered by any valid or collectible insurance, and further, that all property insurance policies shall include the standard "waiver of subrogation" clause.

XIV FORM OF CONTRACT:

The form of the Contract shall be the latest edition of AIA Document No. A101, "The Standard Form of Agreement Between Owner and Contractor"; copies of this form are on file and available for examination at the office of the Architect or from the American Institute of Architects.

XV COPIES OF CONTRACT:

Not less than three (3) copies of the Owner/Contractor Agreement, AIA Document A101, shall be prepared. Additional copies shall be filed where and as may be required.

XVI AWARD OF CONTRACT:

The Owner reserves the right to reject any and all bids or parts thereof, and to waive any irregularities therein. Add and Deduct alternate bids may be accepted or rejected in any order or in any combination as deemed appropriate to the owner.

XVII NOTICE TO PROCEED:

Upon approval by Owner of the Contract Security and Certificate of Insurance and upon execution of the Agreement Between Owner and Contractor, the Owner will issue to the Contractor a Notice to Proceed within 10 days thereafter. The Owner reserves the right, however, to issue the Notice to Proceed following the receipt of Contract Security and Insurance Certificates.

Upon receipt of the Notice to Proceed from the Owner, the Contractor shall sign and date each copy received and shall retain one copy for his files, return two copies to the Owner and transmit one copy to the Architect. The Contractor shall sign, date and return the Notice within 10 days after receipt from the Owner.

XVIII TIME OF START OF WORK:

The starting date for the Work shall be considered to be the date of the Contractor's signature on the Notice to Proceed, as described above.

XIX TIME OF COMPLETION:

Work shall be substantially completed 334 calendar days from the date the Contractor signs the Notice to Proceed.

Work must be completed to attain substantial completion within the time limit as set forth above and, since time is of the essence, Bidders shall base their bids on furnishing sufficient forces and working such shifts as may be required to ensure substantial completion of the Contract Work on or before the date.

Should the Contractor fail to substantially complete the work within the time agreed upon in the contract documents, or within such extra time as may have been allowed by increases in the contract or by formally approved extensions granted by the Owner, the Contractor and the Contractor's surety shall be liable for and shall pay the Owner the sums herein after stipulated as liquidated damages for each calendar day of delay until the work is substantially complete: $750.00 per day. This sum shall be considered and treated not as a penalty but as liquidated damages due the Owner from the Contractor by reason of inconvenience, added costs of engineering and supervision, and other items which have caused an expenditure of additional funds resulting from the contractor's failure to complete the work within the time specified in the contract.

XX PERMITS:

The Contractor shall be responsible for purchasing all applicable building plan review and construction permits and paying all associated permit and utility tap fees. The General Contractor is responsible for applying for and obtaining all building permits and utility taps. All Contractors and Subcontractors are required to be licensed in the City of Sundance.

END OF INSTRUCTIONS TO BIDDERS

BIDDER'S CHECKLIST

- ☐ All blanks on the Bid Form are filled in.

- ☐ Receipt of all addenda is noted on the Bid.

- ☐ Bid is signed by an officer of the corporation or, if not a corporation, a proprietor or partner.

- ☐ (Optional) Facsimile Modification to Bid is signed by an officer of the corporation or, if not a corporation, a proprietor or partner.

- ☐ 10% Bid Bond or 5% Security is included (payable to the City of Sundance).

- ☐ A fully executed “Bidder Affidavit” is submitted with the bid.

- ☐ All above listed forms shall be enclosed in a sealed opaque envelope. The envelope shall state the Bidder’s name and address, shall state: “SEALED BID ENCLOSED”, and shall be addressed to (see the Sealed Envelope Outline example on the following page):

- ☐ For Wyoming resident bidders, provide subcontractor list of first tier subcontractors for proof of 70% Wyoming subcontractors within 24 hours of bid date to the office of the architect at fax number: 307-265-3617. Provide regardless if your firm is the apparent low bidder on bid date.

Return Address
John Smith
Contractor
Box 1
Anytown, USA

To: City of Sundance
c/o: Kathy Lenz, Clerk-Treasurer
213 East Main Street
PO Box 542
Sundance, Wyoming 82729

SEALED BID ENCLOSED: Bid For Old Stoney Remodel – Phase One

To Be Delivered By: *3:00 p.m.* local time, *December 20th* , 2017.

Addenda Received: Nos._____

ASBESTOS STATEMENT

It is brought to the contractor's attention that asbestos containing materials (greater than 1%) may be present outside the project requirements yet within the building or area. the contractor shall take the necessary precautions so as not to disturb this material. if asbestos containing materials are disturbed, the contractor shall follow and comply with the state rules.

All bidders and contractors hereby notified that to the best knowledge of the owner or those representing him in any capacity, this project does not involve asbestos containing materials (greater than 1%). bidders are further instructed that no asbestos containing materials are to be installed in this project.

The contractor is cautioned that hidden materials unknown to the owner and inaccessible for testing may be found during the demolition work of this project which may be asbestos containing materials. Proper procedures shall be followed upon discovery of these materials. The owner or those representing the owner in any capacity shall not be held responsible or liable for any injury or cost to any person resulting from handling of, or proximity to such materials.

Neither the owner, employees or agents of the owner, nor any other person may have any claim, right or action against the prime contractor for any asbestos related injury or damage arising from the activities or a certified asbestos abatement subcontractor. Unless exempt under applicable state and federal law, no asbestos abatement work shall be performed except by a certified asbestos contractor. A certified asbestos abatement subcontractor shall hold the owner and general contractor harmless from any liability arising from such subcontractors activities on the project. A certified asbestos abatement contractor shall cause the owner and, if acting as a subcontractor, the general contractor to be named as additional insured’s and provide sufficient proof of insurance for the purpose of this section.

No asbestos-containing materials have been specified for this project and none shall be installed. Upon completion of this project all subcontractors and material suppliers shall provide the owner a letter stating that no asbestos-containing materials were used in the construction of this facility.

BID FORM
OLD STONEY REMODEL – PHASE ONE
108 NORTH 4TH STREET
SUNDANCE, WYOMING

This proposal is herewith submitted in accordance with your Advertisement inviting proposals to be received for the project identified as:

Old Stoney Remodel – Phase One
108 North 4th Street
Sundance, Wyoming

The undersigned herein agrees to furnish all labor, materials, equipment and services to accomplish the work required in accordance with the contract documents including Addendum Numbers ____, ____, ____, and ____, issued thereto for the following sums:

BASE BID: Total project including Demolition, General, Civil, Structural, Architectural, Mechanical, and Electrical items shown on the plans and described in these specifications.

For the Sum of:_____ Dollars ($_____)

ALTERNATES & ALLOWANCES

ALTERNATE #1: HVAC:

Under Alternate #1, provide and install the line set, fan coils, ERV-2, ductwork and all other HVAC equipment and piping on the 2nd level that is required for a complete HVAC system on the 2nd Level.

ADD for the Sum of:_____ Dollars ($_____)

ALTERNATE #2: HVAC Maintenance Contract:

Under Alternate #2, provide a separate maintenance contract for the service and maintenance of the entire HVAC system for 5 years from Date of Substantial Completion from the system installer.

ADD for the Sum of:_____ Dollars ($_____)

In submitting this proposal, it is understood that the right is reserved by the Owner to reject any and all bids and all proposals or to waive any informalities therein, and it is agreed that this proposal may not be withdrawn for a period of 30 days after the date of opening of these proposals.

If a Corporation, name of State:_____

If a Partnership, state full names of all co-partners: _____
_____
_____
_____

Date: _____, 2016 Firm Name:_____

By:_____ Official Address:_____(Seal, if any)

Title: _____

FACSIMILE MODIFICATION TO BID FORM
OLD STONEY REMODEL – PHASE ONE
108 NORTH 4TH STREET
SUNDANCE, WYOMING

This proposal is herewith submitted in accordance with your Advertisement inviting proposals to be received for the project identified as:

Old Stoney Remodel – Phase One
108 North 4th Street
Sundance, Wyoming

Please make the following modifications to our bid on the referenced project. This modification modifies our sealed bid.

Fax to: **307-283-3452**

Note to Bidder: Please circle the appropriate ADD/DEDUCT and "X" out the undesired action.

MODIFICATION TO BASE BID:

ADD / DEDUCT to our Base Bid:
The Sum of:_____ Dollars ($_____)

ADD / DEDUCT to our Alternate #1:
The Sum of:_____ Dollars ($_____)

ADD / DEDUCT to our Alternate #2:
The Sum of:_____ Dollars ($_____)

The undersigned acknowledges receipt of the following addenda to the construction documents (give number and date of each):

Addenda Nos:_____ dated: _____ respectively.

In submitting this facsimile modification bid, it is understood that the right is reserved by the Owner to reject any and all bids and all proposals or to waive any informalities therein, and it is agreed that this proposal may not be withdrawn for a period of 30 days after the date of opening of these proposals.

If a Corporation, name of State:_____

If a Partnership, state full names of all co-partners: _____
_____
_____
_____

Date: _____, 2017 Firm Name:_____

By:_____ Official Address:_____ (Seal, if any)

Title: _____

BIDDER AFFIDAVIT

Country of_____)
) ss
State or Province of_____)

Business Name: _____
Business Address: _____
Affiant's Name: _____
Affiant's Title: _____
Project Name: Old Stoney Remodel – Phase One
Project Location: 108 North 4th Street, Sundance, Wyoming

AFFIDAVIT WHEN RESIDENT (WYOMING) CONTRACTOR

I do hereby affirm that _____resides in the country of The United States in the state of Wyoming and is aware that the state does grant a preference to resident bidders for work on behalf of said state in the amount of 5 (five) percent.

Note: A subcontractor list indicating compliance with 70% Wyoming subcontractors per the Wyoming preference laws must be provided within twenty four hours upon the opening of your bid. Compliance with Wyoming Public Works and Contracts Act, W.S. 16-6-101 thru 16-6-121 is also required.

Dated: _____ Signed_____

AFFIDAVIT WHEN NON-RESIDENT CONTRACTOR

I do hereby affirm that _____resides in the country of _____ in the state or province of_____ and is aware that the state of Wyoming does grant a preference to resident bidders for work on behalf of said state in the amount of 5 (five) percent.

Dated: _____ Signed_____

ACKNOWLEDGEMENT OF AFFIANT

Country of_____)
) ss
State or Province of_____)

On this _____ day of _____, 20 _____, before me personally appeared _____ _____, known to me to be the affiant who, being duly sworn, declares all statements made in this affidavit to be true and correct to the best of his or her knowledge.

_____
Notary Public

My commission expires the _____ day of _____, 20_____

PRODUCT SUBSTITUTION REQUEST

Stateline No 7 ARCHITECTS

PROJECT: Old Stoney – Phase One

PROJECT #: 16-022

FIRM NAME/ADDRESS/PHONE-FAX # OF PROPOSER_____

_____

_____

_____

_____

ATTN:_____

DATE RECEIVED:_____

SUBSTITUTION DEADLINE: Minimum of 10 days prior to the bid date

This Product Substitution Request must be submitted with all substitution requests, or the request may not be considered.

The substitution request must be received at the Architect's office no later than the date indicated above, or the request will not be considered.

By signing below, bidder acknowledges that they are providing a Certificate of Equal Performance and Assumption of Liability for Equal Performance.

Signature_____ **Title**_____

PRODUCT SPECIFIED_____

DIVISION/SECTION_____**PAGES**_____

PROPOSED SUBSTITUTION_____

Please attach additional product information to form so that a complete comparison between the specified item and the substitution item can be thoroughly examined. Highlight and mark pages and items to be considered.

PRODUCT ANALYSIS:

SPECIFIED ITEM DESCRIPTION:	**SUBSTITUTION ITEM DESCRIPTION:**

For Architect/Engineer Use:

THE PROPOSED SUBSTITUTION IS ☐ APPROVED ☐ NOT APPROVED DATE_____

REMARKS_____

_____

307.265.3611 307.265.3617 fax 444 South Center Street Casper, WY 82601 www.stateline7.com

BID BOND

AIA DOCUMENT A310

AVAILABLE FROM THE ARCHITECT
(OR FROM THE AMERICAN INSTITUTE OF ARCHITECTS)

STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

AIA DOCUMENT A101

AVAILABLE FROM THE ARCHITECT
(OR FROM THE AMERICAN INSTITUTE OF ARCHITECTS)

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

AIA DOCUMENT A201

AVAILABLE FROM THE ARCHITECT
(OR FROM THE AMERICAN INSTITUTE OF ARCHITECTS)

SUPPLEMENTAL GENERAL CONDITIONS
(to AIA A201 GENERAL CONDITIONS TO THE CONTRACT FOR CONSTRUCTION)

ARTICLE 1 – GENERAL PROVISIONS

1.1.1 THE CONTRACT DOCUMENTS *(Delete the last sentence and add the following:)*

Bidding Documents, including but not limited to advertisement or invitation to bid, Instructions to Bidders, the Contractor's Bid, and addenda or portions of addenda relating to any bidding documents.

(Add the following:)

1.1.9 NOT IN CONTRACT (N.I.C.)

All items indicated "N.I.C." (Not in Contract) on the Drawings or in the Specifications are items either furnished, installed and connected by the Owner, or excluded from the Contract.

(Add the following:)

1.1.10 OWNER FURNISH CONTRACTOR INSTALL (O.F.C.I.)

All items indicated "O.F.C.I." (Owner Furnished Contractor Install) on the Drawings or in the Specifications are to be furnished by the Owner and unloaded by the Contractor at the site in a location as directed by the Contractor. The Contractor shall move such items to the location of use in the building. The installation and/or service connections of this equipment shall be the responsibility of the Contractor as set forth in the Specifications and Drawings.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

(Add the following:)

1.2.1.1 In the event of conflicting provisions among the Contract Documents that were not called to the Architect's attention prior to award of the Contract, the Architect shall determine which of the conflicting requirements shall govern, generally taking as a guideline the more stringent requirement or more expensive material, unless, in the opinion of the Architect, another requirement is more appropriate. The Architect's decision shall be final in such case, and the Architect's decision shall not be further reviewable by arbitration or by litigation.

ARTICLE 3 – CONTRACTOR

3.2 **REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

3.2.1. *(Add the following paragraph:)*

In addition to and not in derogation of the Contractor's duties under these General Conditions, the Contractor shall take field measurements and verify conditions and other information known to the Contractor with the Contract Documents before commencing Work. Errors, inconsistencies, or omissions discovered or which reasonably should have been discovered shall be reported to the Architect and Owner at once. The Contractor shall be responsible for any errors, inconsistencies, or omissions that are not discovered but that reasonably should have been discovered by a prudent contractor performing the services to be provided hereunder.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 *(Add the following:)*

The Contractor shall engage workers who are skilled in performing the Work, and all Work shall be performed with care and skill and in a good workmanlike manner under the full-time supervision of an approved foreman. The Contractor shall be liable for all property damage, including repairs and replacements of the Work and economic losses, which proximately result from the breach of this duty. The Contractor shall advise the Architect:

a) If a specified product deviates from good construction practices;

b) If following the Specifications will affect any warranties; or

c) any objections which the Contractor may have to the Specifications.

Nothing contained in Subparagraph 1.1.3 shall alter the responsibilities established in this Subparagraph.

(Add the following:)

3.3.4 Immediately upon commencement of the Work, the Contractor shall retain the services of a licensed surveyor to verify the boundaries of the site and establish benchmarks for the Work. All discrepancies shall be immediately brought to the attention of the Architect.

3.6 TAXES

3.6 (Add the following to the end of the paragraph:)

…….. including but not limited to all sales taxes, use taxes, occupational taxes, excise taxes, Social Security benefits, unemployment compensation taxes, or similar levies on all materials, labor, tools, and equipment furnished under this Agreement, as required by the statutes of the state of Wyoming.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULE

3.10.1 (Add the following paragraph:)

The Owner's or Architect's silence as to a submitted schedule that exceeds time limits current under the Contract Documents shall not relieve the Contractor of its obligation to meet those time limits, nor shall it make the Owner or Architect liable for any of Contractor's damages incurred as a result of increased construction time or not meeting those time limits. Similarly, the Owner's or Architect's silence as to a Contractor's schedule showing performance in advance of such time limits shall not create or infer any rights in favor of the Contractor for performance in advance of such time limits.

*3.10.2 (**Delete** the word **"approval"** and **substitute** the word **"review"** and add the following to the end of the paragraph:)*

Neither the Contractor's preparation nor the Architect's receipt or review shall modify the Contractor's responsibility to make required submittals or to do so in a timely manner to provide for review in accordance with paragraph 4.2.7 as modified herein.

(Add:)

3.10.2.1. The schedule of submittals shall be submitted along with the construction schedule.

3.15 CLEANING UP

3.15.1 (Delete and replace with the following:)

The Contractor shall keep the site of the Work and adjacent premises as free from material, debris, and rubbish as is practicable, and shall remove same from any portion of the site, if, in the opinion of the Owner's representative such material, debris, or rubbish constitutes a nuisance or is objectionable in any way to the Owner. The Contractor further agrees to remove all machinery, materials, implements, barricades, staging, falsework, debris, and rubbish connected with or caused by the Work immediately upon the completion of the Work, and to clean all structures and work under the Contract Documents to the satisfaction of the Owner's representative, and to leave the premises in perfect condition insofar as affected by the Work hereunder. The Contractor shall be liable for all costs, liability, and expense, including but not limited to court costs, for all claims related to the control of dust.

(Add:)

3.15.3 At the completion of the Work and before acceptance and final payment, the Contractor shall restore and replace in a suitable manner all public and private site property which has been damaged or removed in the performance of this Contract. Site property includes portions of any and all structures, and adjacent portions of any streets, alleys, lawns, sidewalks, paving or property used in executing the Work.

ARTICLE 9 – PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

(Add:)

9.2.2 The Contractor shall submit to the Architect a breakdown of the Contract price within 15 days after issuance of a Notice to Proceed. Refer to the General Conditions, Article 9.2., as modified herein.

The prices shown on the schedule will be used for determining the basis of partial payments and will not be used for pricing changes in the Work.

The Schedule of Values shall be a detailed breakdown on a form provided by the Contractor. If the Schedule is submitted without sufficient detail, the Architect will request additional information and withhold approval of partial payments until complete price data is received. Omission by the Contractor of any item, device, equipment or part shall not relieve the Contractor from furnishing same when required by the Contract Documents.

The minimum information for the Schedule of Values shall be a listing of each section of each Division along with major sections of the particular division. Each unit of Work shall show one price and that price shall include labor, material, profit, overhead, temporary facilities, labor benefits, permits and fees, taxes, testing and miscellaneous. Bonds and insurance shall not be included in the "Unit of Work" price shall be listed separately as Items 1 and 2 of the price schedule.

9.3 APPLICATION FOR PAYMENT

9.3.1 *(Add the following:)*

The Contractor shall furnish the Owner, with each Application for Payment, a notarized Contractor's affidavit in a form satisfactory to the Owner's title company, along with proper waivers of lien and other supporting documentation sufficient to satisfy said title company that payment is properly due the Contractor.

(Add:)

9.3.1.3 The Architect will authorize ninety percent (90%) of the amount due the Contractor on account of progress so long as there are no outstanding liens or claims and so long as in the opinion of the Owner the previous work has been done properly and is on schedule for completion of the construction and the unpaid balance is sufficient to complete the unfinished work. No interest shall be paid on retention amounts.

9.8 SUBSTANTIAL COMPLETION

9.8.1 *(Delete and replace with the following:)*

Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof (which the Owner agrees to accept separately) is sufficiently complete in accordance with the Contract Documents so the Owner can legally and practicably occupy and utilize the Work for its intended use.

(Add:)

9.8.1.1 The Work will not be considered suitable for Substantial Completion review until all Project systems included in the Work are operational as designed and scheduled, all designated or required governmental inspections and certifications, including certificates of occupancy, have been made and posted, designated instruction of the Owner's personnel in the operation of systems has been completed, and all final finishes within the Contract Documents are in place. In general, the only remaining Work shall be minor in nature, so that the Owner or Owner's tenants could occupy the building and site on the date and the completion of the Work by the Contractor would not materially interfere with or hamper the normal business operations of the Owner or Owner's tenants (or those who claim by, through, or under Owner). As a further condition of Substantial Completion acceptance, the Contractor shall certify that all remaining Work will be completed within thirty (30) consecutive calendar days or as agreed upon following the Date of Substantial Completion.

9.8.2 (Add the following:)

The Architect will make only two (2) such inspections to determine substantial completion. If these inspections determine that the work is not substantially complete, either because of major items not completed or an excessive number of punchlist items, successive inspections requested by the Contractors shall be charged to the Contractor at a rate of $500.00 per person per day.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 *(Add the following:)*

The Architect will make only two (2) such inspections to determine final completion. If these inspections determine that the Work is not finally complete, successive inspections requested by the Contractor shall be charged to the Contractor at a rate of $500.00 per person per day.

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.7 *(Delete and substitute the following:)*

All parts of the Work shall be braced to resist wind or other loads. The Contractor shall perform the Work with the explicit understanding that the design of the Project is based on all parts of the Work having been completed and as such, the methods of performance of each part of the Work shall be done accordingly and entirely at the Contractor's choice.

(Add:)

10.2.8.1 Temporary items such as, but not limited to; scaffolding, staging, lifting and hoisting devices, shoring, excavation barricades, and safety and construction procedures necessary in completion of the Project shall be the responsibility of the Contractor and his subcontractors and shall comply with all applicable codes and regulations. OSHA Standards covering the construction industry shall be complied with in every respect. It shall not be the responsibility of the Owner or the Architect to determine if the Contractor, subcontractors or their representatives are in compliance with the aforementioned regulations.

ARTICLE 11 – INSURANCE AND BONDS

11.4 PERFORMANCE BOND AND PAYMENT BOND

11.4.1 *(Delete and substitute the following:)*

The Contractor shall pay for and furnish a Performance Bond and Labor and Material Payment Bond, each in the amount equal to 100% of each Contract sum. Such bonds are to be executed on the AIA Forms enclosed by a corporate surety company licensed by the State of Wyoming to issue such bonds, and acceptable at the sole option of the Owner. Bonds shall remain in force throughout the warranty period; that is, one year beyond final completion.

END OF SUPPLEMENTAL GENERAL CONDITIONS

PERFORMANCE BOND

AIA DOCUMENT A311

AVAILABLE FROM THE ARCHITECT
(OR FROM THE AMERICAN INSTITUTE OF ARCHITECTS)

LABOR AND MATERIAL PAYMENT BOND

AIA DOCUMENT A311

AVAILABLE FROM THE ARCHITECT
(OR FROM THE AMERICAN INSTITUTE OF ARCHITECTS)

DIVISION

1

GENERAL REQUIREMENTS

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Old Stoney - Phase One

B. Owner's Name: The City of Sundance.

C. Architect's Name: Stateline No.7 Architects.

D. The Project consists of the remodel of three floor levels of the existing 1924 post-and-beam, wood joist framed, cut stone load bering masonry wall building with salb on grade and wood framed floors and spread (assumed rubble stone) footings..

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in the Standard Form of Agreement Between Owner and Contractor.

1.03 WORK BY OWNER

A. Owner will provide or supply and install the following:
   1. Furnishings.
   2. Museum displays and exhibits.
   3. High density shelf units (only) for contractor installation.
   4. Moving of exterior Old Jail structure.

B. Owner will salvage and supply the following for installation by Contractor:
   1. Interior door leafs as indicated on the drawings (for refinishing and hardware by the contractor).
   2. Interior wood trim as indicated on the drawings (for refinishing by the contractor).
   3. Exterior steel frame window frames as indicated on the drawings (for refinishing and reglazing by the contractor).

C. Owner will provide the following items for the contractor to install (OFCI) or coordinate the installation with a owner-provided subcontractor:
   1. Miscellaneous equipment items as noted on the drawings.

1.04 FUTURE WORK

A. Project is designed for future Phase Two project on the upper floor level..

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Site boundaries and surrounding street parking (coordinate with City) can be utilized taking care not to disturb surrounding businesses.

B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner: exterior masonry work if budget allows.

C. Provide access to and from site as required by law and by Owner:
   1. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Existing building spaces may be used for storage only when not occupied by owner.

E. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the site is unoccupied.
   2. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE

A. Coordinate construction schedule and operations with Architect and Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. AIA Document A101 Standard Form of Agreement Between Owner and Contractor: Contract sum, retainages, payment period, monetary values of unit prices.

1.03 SCHEDULE OF VALUES

A. Form to be used: AIA G703.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in duplicate within 7 days after date of Owner-Contractor Agreement.

E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: monthly.

B. Form to be used: AIA G702 and G703.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

H. Include the following with the application:
   1. Partial release of liens from major Subcontractors and vendors as stipulated in the Owner Contractor agreement.
   2. Affidavits attesting to off-site stored products.

I. When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for pricing Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Submittals for review, information, and project closeout.

E. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

B. Section 01 7800 - Closeout Submittals: Project record documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via email or alternatively with an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. It is Contractor's responsibility to submit documents in PDF format.
3. If an alterante internet based submittal service is used, Subcontractors, suppliers, Architect and Architect's consultants are to be permitted to use the service at no extra charge.
4. Paper document transmittals will not be reviewed.
5. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Cost: The cost of the alternate internet based submittal service, if used, is to be paid by Contractor; include the cost of the service in the contract sum.

C. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:

1. Owner.
2. Architect.
3. Contractor.

C. Items to be submitted to the architect prior to preconstruction meeting:

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Submission of list of Subcontractors, schedule of values, and overall project schedule.
4. Designation of personnel representing the parties to Contract and Architect.
5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

6. Scheduling.

D. Architect will record minutes and distribute copies within three days after meeting to participants, with copies to Architect, Owner, and Contractor.

3.03 PROGRESS MEETINGS

A. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Special Consultants.
5. Contractor's Superintendent.
6. Major Subcontractors when necessary.
7. Owner's vendors and equipment suppliers when necessary

C. Agenda:
1. Review of Work progress.
2. Field observations, problems, and decisions.
3. Identification of problems that impede, or will impede, planned progress.
4. Review of submittals schedule and status of submittals.
5. Review of off-site fabrication and delivery schedules.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Coordination of projected progress.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to Work.

D. Architect will record minutes and distribute copies within seven days after meeting to participants, with copies to Architect, Owner, and Contractor.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Ensure that major subcontractors have reviewed and accepted proposed schedule prior to submittal.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule every 30 days.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

C. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Documents for Review:
   1. Submit all sheets and information in digital/electronic format (PDFs). Provide hard copies of colors/materials to be selected.

C. Samples: Submit the number specified in individual specification sections; two of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.
   3. Contractor responsible for all costs associated with procuring samples.

3.09 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Do not reproduce the Contract Documents to create shop drawings.
   3. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

B. Transmit each submittal with a copy of approved submittal form.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Deliver submittals to Architect at business address or email electronic / PDF submittals.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each color/material sample submittal for review, allow 10 business days excluding delivery time to and from the Contractor.

H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

I. Provide space for Contractor and Architect review stamps.

J. When revised for resubmission, identify all changes made since previous submission.

K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Test Reports: After each test/inspection, promptly submit electronic copies of report to Architect, Owner and to Contractor.

1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.
    d. Date and time of sampling or inspection.
    e. Identification of product and specifications section.
    f. Location in the Project.
    g. Type of test/inspection.
    h. Date of test/inspection.
    i. Results of test/inspection.
    j. Conformance with Contract Documents.
    k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the

standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor is responsible for coordinating and scheduling of materials testing agency.

D. Costs for re-testing due to failure to meet specifications shall be borne by the General Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Mock-ups will be reviewed at the regular owner-architect-contractor progress meetings.

D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Make corrections as necessary until Architect's approval is issued.

G. Accepted mock-ups shall be a comparison standard for the remaining Work.

H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work .
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers and enclosures.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. New permanent facilities may be used.

C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office and/or superintendent at time of project mobilization.

B. Optional land line telephone, facsimile, and/or email may be provided if deemed necessary by the General Contractor.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. New permanent facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide protection for plants designated to remain. Replace damaged plants.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

D. Traffic Controls: Provide control of construction access to and from project site onto surrounding public streets..

1.06 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site and open excavations; equip with vehicular gates with locks.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 SECURITY

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Existing off-site street parking may be used for construction parking. Coordinate with surrounding local businesses.

1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on Drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table.
   1. Existing building may be used for contractors office.

B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.

C. Locate offices a minimum distance of 20 feet from existing structures. Confirm location with owner prior to installation.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet unless noted otherwise. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Procedures for Owner-supplied products/items.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Document "Instructions to Bidders": Product options and substitution procedures prior to bid date.

B. Section 01 1000 - Summary: Lists of products to be removed from existing building.

C. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.04 QUALITY ASSURANCE

A. Reused Products: Materials and equipment previously used in this or other construction, salvaged and refurbished as specified and show in the drawings.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:

1. Containing lead, cadmium, asbestos.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period and the documents required. Comply with requirements specified in Section 00 2113.

B. Architect will consider requests for substitutions only within 30 days after date per the Instructions to Bidders.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   2. Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   4. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 1000 - Summary: Coordination of owner supplied items, etc.

C. Section 01 3000 - Administrative Requirements: Submittals procedures.

D. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

F. Section 01 5000 - Temporary Facilities and Controls: Temporary heating, cooling, and ventilating facilities.

G. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Visual qualities of sight exposed elements.
   3. Work of Owner or separate Contractor.
   4. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For survey work, employ a land surveyor registered in the State of Wyoming and acceptable to the Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State of Wyoming.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design for this type of work and licensed in the State of Wyoming and see additional requirements in the structural drawings.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion. Comply with requirements of SWPPP plan as required by Wyoming DEQ.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that established by Owner provided survey.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

K. Periodically verify layouts by same means.

L. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Verify that abandoned services serve only abandoned facilities.
   2. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel ____ prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See specific mechanical specification section.

3.13 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.
   1. Clean areas to be occupied by Owner prior to final completion and Architect punch walkthrough before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass (including previously installed windows), surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

J. Clean Owner-occupied areas of work.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

D. Owner will occupy all of the building as specified in Section 01 1000.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Record information for "as-built" drawings concurrent with construction progress.

D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractorand subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Original warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized (if required).

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

DIVISION

2

EXISTING CONDITIONS

SECTION 02 4100

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 1000 - Summary: Description of items to be removed by Owner.

C. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

D. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

F. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

G. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

H. Section 31 2000 - Earth Moving: Grading and Fill after removal.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of five years of documented experience. Experience with historic building demolition preferred.

PART 3 EXECUTION

2.01 SCOPE

A. Remove portions of existing buildings elements as indicated on drawings.

B. Remove concrete slabs on grade as indicated on drawings.

C. Remove other items indicated, for salvage, relocation, and demolition.

D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in section 31 2000 Earth Moving.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.

3. Use of explosives is not permitted.
4. Take precautions to prevent catastrophic or uncontrolled collapse of structures during demolition; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permit.
9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring as needed to maintain stablity of existing structure.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if the structure or adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems (including those of adjacent off-site properties) that are in use without at least 7 days prior written notification to appropriate Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as shown.
2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary (even if not shown or indicated on the drawings).
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

2.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

DIVISION

3

CONCRETE

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete for composite floor construction.

C. Floors and slabs on grade.

D. Concrete elevator shaft walls, foundation walls, and footings.

E. Concrete reinforcement.

F. Joint devices associated with concrete work.

G. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, and thrust blocks.

H. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.

B. Section 32 1313 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

F. ACI 305R - Hot Weather Concreting; 2010.

G. ACI 306R - Cold Weather Concreting; 2010.

H. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

J. ACI 347R - Guide to Formwork for Concrete; 2014.

K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

L. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b (Reapproved 2014).

M. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

P. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

Q. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

R. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

S. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

T. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

U. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

V. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

W. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

X. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

Y. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

Z. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement; 2012.

AA. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2014.

AB. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

AC. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

AD. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2011.

AE. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011.

AF. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

C. Material Certificates: For each of the following signed by manufacturer.
   1. Curing compounds.
   2. Repair materials.

D. Mix Design: Submit proposed concrete mix design.
   1. Submit mix design and substantiating data for each concrete mixture contemplated fro use on the project. Provide mix identificatino designation with statement of intended use for mix.
   2. Mix Designs shall be received by teh Architect not less than four weeks prior to the first concrete placement.

E. Shop Drawings:
   1. Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, adn location of splices. Provide one continuous elevation at 1/4" scale for all beams, walls or joists in a common line.
   2. Provie drawings showing construction adn control joint locations alence of pours.
   3. Proivde dimensioned drawings of foundation wall formwork.

F. Field quality-control test and inspection reports.

G. Placement notification: Advance notification of concrete placement; submit notification at least 24 hours in advance.

H. Material test reports:

1. If non-reactive aggregates are proposed, include service record data and test reports in accordance with ASTM C1260. Record data and test reports shall be dated within the past 12 montsh.
2. If reactive aggregates are proposed, include test reports in accordance with ASTM C1567. Test reports shall be dated within the pat 12 months and shall indicate compliance with the requirements set forth in the drawings.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Record of Work: Maintain a record listing the time and date of placement of all concrete for the structure. Retain batch tickets for all concrete. Such record shall be kept until the completion of the project and shall be available to the Architect for examination at any time.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate, reactive or non reactive, from one source and obtain admixture through one source from a single manufacturer.
   1. Preinstallation Confrence: Conduct conference at Project site.
   2. 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. Ready-mix concrete manufacturer.
      c. Concrete subcontractor.
      d. Geotechnical engineer.
      e. Owner's Testing/Inspection Agency.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 1000.

B. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

C. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Steel.
   2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.
   3. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.

C. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I/II Modified Portland type for sulfate resistance..
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: Clean and not detrimental to concrete.

E. Structural Fiber Reinforcement: ASTM C1116/C1116M, Type III.
   1. Fiber Type: Polyolefin macro fibres engineered and designed for use in concrete.
   2. Fiber Length: 1 to 2 1/4 inch.
   3. Fibers to be conducive to finish acceptable to Architect.

F. Early Age Crack-Control Fiber Reinforcement: ASTM C1116/C1116M.
   1. Fiber Type: Alkali-resistant polypropylene.
   2. Fiber Length: ___ inch, nominal.
   3. Manufacturers:
      a. GCP Applied Technologies; Grace Fibers: www.gcpat.com/concrete/#sle.
      b. GCP Applied Technologies; Grace MicroFiber: www.gcpat.com/concrete/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

C. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Grout: Comply with ASTM C1107/C1107M.
   2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
      a. Maximum: Plus 4 percent.
      b. Minimum: Plus 1 percent.
   3. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   4. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Silane Hybrid Anchoring System:
   1. Complying with ASTM C881/C881M and of Type required for specific application.
   2. Manufacturers:
      a. Adhesives Technology Corporation; ULTRABOND 365CC: www.atcepoxy.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.
   1. Manufacturers:
      a. Aquafin, Inc; _____: www.aquafin.net.

b. W. R. Meadows, Inc; ADI-CON CW Plus: www.wrmeadows.com/#sle.
c. Xypex Chemical Corporation; XYPEX Concentrate: www.xypex.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

D. Waterstops: Rubber, complying with COE CRD-C 513.
1. Configuration: As indicated on the drawings.
2. Size: As indicated on the drawings.
3. Manufacturers:
a. _____.
b. _____.
c. Substitutions: See Section 01 6000 - Product Requirements.

E. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
1. Size: As indicated on drawings.

F. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

G. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

H. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.
1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
2. Height: To suit slab thickness.

I. Plate Dowel System: Steel plate dowel and plastic dowel sleeve; with integral fasteners for attachment to formwork.
1. Manufacturers:
a. BoMetals, Inc; QuicPlate: www.bometals.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
1. Application: Use at slabs.
2. Vehicle: Solvent-based.
3. Solids by Mass: 25 percent, minimum.
4. VOC Content: OTC compliant.

C. Moisture-Retaining Sheet: ASTM C171.
1. Curing paper, regular.
2. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch.
3. White-burlap-polyethylene sheet, weighing not less than 10 ounces per linear yard, 40 inches wide.
4. Required Locations: All locations of exposed slab work.

D. Polyethylene Film: ASTM D2103, 4 mil thick, clear.

E. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
   1. Compressive Strength: refere to Structural Drawings for Mix Design Table.
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Water-Cement Ratio: refer to the structural drawings for mix design table.
   4. Total Air Content: refer to the structural drawings for mix design table.
   5. Maximum Aggregate Size: refer to the structural drawings for mix design table.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

E. A706 reinforcement bars may be field bent one time; do not re-bend any reinforcing bars.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on the drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.

G. Construction Joints: as shown on the structural drawings.

H. Do not interrupt successive placement; do not permit cold joints to occur.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than 7 days.

C. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
      a. Spraying: Spray water over floor slab areas and maintain wet.
      b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
   3. Final Curing: Begin after initial curing but before surface is dry.
      a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
      b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 3511

CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Applying sealer and hardener, and polishing concrete to the specified finish level.

1.02 RELATED REQUIREMENTS (THIS LIST MAY NOT BE ALL INCLUSIVE)

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 07 9005 - Joint Sealers: Joint-sealant materials in conjuctions with concrete flooring systems.

1.03 REFERENCE STANDARDS

A. Skidability Static, Co-efficient of friction: ASTM 1028- All levels of finish to exceed OSHA and ADA recommendations for wet and dry hard surfaces.

B. ASTM-C779, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.

C. ASTM G23-81, Ultraviolet Light & Water Spray.

D. ASTM C805, Impact Strength.

E. ACI 302. IR-89, Guide for Concrete Floor and Slab Construction.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

B. Preinstallation Meeting:
   1. Convene a pre-installation meeting under general provisions of Section 01 7000.
   2. Conduct a review of procedures required to produce specified results.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Submit special concrete finishes manufacturer’s specifications and test data.
   2. Submit special concrete finishes describing product to be provided, giving manufacturers name and product name for the specified material proposed to be provided under this section.
   3. Submit special concrete finishes manufacturers recommended installation procedures; which when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.
   4. Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.
   5. Submit special concrete finishes manufacturers Material Safety Data Sheet (MSDS) and other safety requirements.
   6. Submit all special concrete finishes and published manufacturers installation instructions.
   7. Include information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 MOCK-UP

A. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Deliver materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage.

C. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

1.08 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Maintain ambient temperature of 50 degrees F minimum.

C. Environmental limitations:
   1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
      a. Concrete Floor Flatness rating recommended at 50.
      b. Concrete Floor Levelness rating recommended at 50.
      c. Concrete must be cured a minimum of 45-days or as directed by the manufacturer before application of Lion Hard can begin.
      d. Application shall take place 10-days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.

D. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

1.09 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced installer and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
   2. The special concrete finish manufacturer shall certify applicator.
   3. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.
   4. Past performance history must be submitted detailing three projects of similar size and complexity including contact information of the owner and construction manager.

B. Protection:
   1. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.
      a. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
      b. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
      c. No pipe cutting machine will be used on the inside floor slab.
      d. Steel will not be placed on interior slab to avoid rust staining.
      e. Acids and acidic detergents will not come into contact with slab.
      f. All trades informed that the slab must be protected at all times.
      g. Do not protect slab with plastic or non-breathable membrane.

C. Mock-Ups:
   1. Apply mock-ups of each type finish, to demonstrate “Exposed Sand Finish”, typical joints, perimeter edging, surface finish, color variation (if any), and standard of workmanship.
      a. Build mock-ups in an area directed by the Architect. Mock-up will be reviewed under conditions similar to those which will exist during actual placement.
      b. Obtain from the Architect, approval of mock-ups before starting construction.
      c. Maintain mock-ups during construction in an undisturbed condition as a standard for judging workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
      d. Mock-Up Size: 10 SF
   2. Mockup will show specified level of cut and gloss to be:
      a. Level of Cut: Grade 3, Medium Aggregate - medium aggregate exposure with little or no large aggregate exposure at random locations within the concrete. This level of cut generally can be achieved within 1/8" of the surface.

b. Finished Gloss: Class 3, Semi-Polished - Objects being reflected are not quite sharp and crisp but can be easily identified. Used to show level of sheen when concrete is mechanically processed as outlined in Installation. Reflective Clarity: ASTM D5767 >65. Reflective Sheen: ASTM D523 >35, medium to high. Grit range of 800 and higher with minimum of 6 abrasive passes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

B. Performance Criteria:
   1. Abrasion Resistance: ASTM C779 - Up to 400% increase in abrasion resistance.
   2. Impact Strength: ASTM C80S - Up to 21 % increase impact strength.
   3. Ultra Violet Light and Water Spray: ASTM G23-81 - No adverse effect to ultra violet and water spray.

C. Acceptable Manufacturers:
   1. L&M Construction Chemicals, Inc., 14851 Calhoun Road, Omaha, NE 68152. Ph: (402) 453-6600, Fx: (402)453-0244, www.lmcc.com
   2. Metzger/McGuire, Inc., PO Box 2217, Concord, NH, 03302; Ph: 800-223-6680, Fx: (603) 224-6020, www.metzgermcguire.com
   3. Substrate Technology, Inc., 1384 Bungalow Rd., Morris, IL 60450; Ph: (815) 941-4800, Fx: (815) 941-4600; www.substratetechnology.com
   4. Ameripolish Inc.- Architectural Concrete Products, 120 Commercial Avenue, Lowell, AR 72745 Ph: (479)725-0033, Fx: (479) 725-0031, www.ameripolish.com
   5. Substitutions - See Section 01 6000 - Product Requirements.

2.02 CONCRETE FLOOR FINISH APPLICATIONS

A. Liquid Densifier/Hardener: Product to be determined.

B. Penetrating Clear Sealer:

2.03 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set. Water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
   1. Products:
      a. L&M Construction Chemicals, Inc., a subsidiary of Laticrete International, Inc; Product: LION HARD Lithium Densifier
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 COATINGS

A. Water and Oil Repellant Sealer: Transparent, non-yellowing, water- or solvent-based coating.
   1. Composition: Modified "neat" silane system with small molecular structure
   2. VOC Content: maximum 400 g/L
   3. Products:
      a. Prosoco, Inc.; SLX100 Water & Oil Repellent: www.prosoco.com
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 SEMI-RIGID JOINT FILLER

A. 100% solids, two component, heavy duty semi-rigid epoxy joint filler designed to fill and protect contraction and construction joints in concrete floors.
   1. Products:
      a. Metzger/McGuire, Inc., Product: MM-80 Epoxy Polymer Semi-Rigid Joint Filler
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 CONCRETE PREPARATION

A. Concrete preparation and polishing machinery.

1. Equipment:
    a. Substrate Technology, Inc., Equipment: Prep Master Concrete Grinding and Polishing Machines
    b. Substitutions: See Section 01 6000 - Product Requirements.
2. Diamond Consumable Tooling:
    a. Substrate Technology, Inc., Tooling: 10 Segment Metal Bond Tool (2 grits), Terrazzo Pad (1 grit) and FL-07 Polishing Pad (5 grits)
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 POLISHED CONCRETE DYE SYSTEM

A. Solvent-based dye using extremely fine molecules of color designed to penetrate and color floor surfaces in conjuction with polished concrete.
    1. Products:
        a. Ameripolish, Inc. Product: Ameripolish Solvent-Based Concrete Dye
        b. Substitutions: See Section 01 6000 - Product Requirements.

2.08 SOURCE QUALITY CONTROL

A. Ensure concrete finishing components and materials are from single manufacturer.

PART 3 EXECUTION

3.01 MANUFACTURERS INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and L&M Chemicals, SPEC-DATA sheets.

B. Use only certified L&M Lion Hard installers.

3.02 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

C. Verify new concrete is cured to 28 day, 3500 psi strength.

D. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement.

E. Verify new concrete FF (flatness and levelness) of 50(flat) is obtained based on Face Floor Profile Numbers (http://www.ribmc2.com/estref/popular_conversion_files/concrete/slab_flat.html).

3.03 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.04 PREPARATION

A. Ensure surfaces are clean and free of dirt, previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other foreign matter harmful to performance of concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

C. General Contractor to remove surface contamination.

D. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

E. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

3.05 COATING APPLICATION

A. Work to be performed by certified manufacturer applicators.

B. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

C. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

D. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

E. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.06 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Semi-Gloss Finish: Reflecting overhead and side images from 35 to 45 feet away.

B. Floor Surface Polishing and Treatment:
   1. Grind substrate to clearly expose sand and polish to a “Semi-Gloss Sheen” as directed by the Architect.
   2. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
   3. Apply floor finish prior to installation of fixtures and accessories.
   4. Diamond-grind and polish concrete floor using Prep Master Polisher and the following procedure.
      a. Remove surface contaminants using 30 grit 10 segment diamond; wet or dry depending on nature of contaminants.
      b. Grind floor using 70 grit 10 segment diamond; wet or dry depending on nature of concrete strength.
      c. Polish floor using 100 grit Terrazzo Pad; wet or dry depending on nature of concrete strength.
      d. Grout floor to fill voids and defects.
   5. Remove defects and re-polish defective areas.
   6. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

C. Protect finished surface as required and as recommended by manufacturer of polishing system.

3.07 ADJUSTMENTS

A. Saw and fill control joints with specified joint filler prior to grinding concrete.

3.08 FINAL CLEANING

A. Perform clean-up in accordance with Section 01 7000 - Execution and Closeout Requirements.

B. Mechanically scrub treated floors with soft to medium pads or brushes with approved cleaning solution.

C. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

3.09 PROTECTION

A. General contractor must protect installed product from damage during construction, refer to section 1.08 Quality Assurance, C.

B. Protect with EZ Cover™ by McTech Group, masonite sheeting duct taped on seams or comparable product.
   1. McTech Group Inc., Ph: (866) 913-8363, Fx: (770) 913-8307, www.mctechgroup.com

END OF SECTION

DIVISION

4

MASONRY

SECTION 04 2001

MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Block.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Flashings.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 02 4100 Demolition - Demolition of openings for masonry infill.

B. Section 09 9000 - Painting and Coating: Field finish of exterior CMU units.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

J. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

K. BIA Technical Notes No. 7 - Water Penetration Resistance - Design and Detailing; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 4 inches.
   2. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M Type N or Type S.
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. Hydrated Lime: ASTM C207, Type S.

C. Grout Aggregate: ASTM C404.

D. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

A. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.
   4. Manufacturers:
      a. Hohmann & Barnard, Inc; _____: www.h-b.com/sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FLASHINGS

A. Plastic Flashings: Sheet polyolefin laminated to polypropylene; 40 mil thick.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; _____: www.h-b.com/sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Pre-Coated Galvanized Steel: ASTM A653/A653M, with G90/Z275 coating, 24 gage, 0.0239 inch base metal thickness, shop precoated with fluoropolymer coating in color matching other exterior metal trim.

2.05 ACCESSORIES

A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

B. Weeps: Cotton rope.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
   1. Masonry below grade and in contact with earth; Type S.
   2. Exterior, non-loadbearing masonry; Type N.

B. Grout: ASTM C476; consistency as required to fill volumes completely for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 32 inches on center horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and at above grade locations where brick goes below grade.

B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

B. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

C. Reinforce joint corners and intersections with strap anchors 16 inches on center.

3.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 8 inches, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend plastic flashings to within 1/4 inch of exterior face of masonry.

C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form expansion joint as detailed on drawings.

3.09 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

D. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.10 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

3.11 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.12 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Once brick/block is cleaned and dried, install graffiti resistant coating per manufacturer's recommendations.

END OF SECTION

DIVISION

5

METALS

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Base plates, shear stud connectors.

C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

B. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2011.

B. 11

C. ASTM A1 - Standard Specification for Carbon Steel Tee Rails; 2000 (Reapproved 2010).

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

I. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2004 (Reapproved 2009).

J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

K. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

L. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

M. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2014.

N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).

O. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).

P. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

Q. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).

R. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.

S. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2012.

T. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2014.

U. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

V. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2013.

W. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

X. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2011.

Y. ASTM F2280 - Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2012.

Z. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

AA. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

AB. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

AC. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

AD. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Fabricator: Company specializing in performing the work of this section with minimum five years of documented experience.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

D. Erector: Company specializing in performing the work of this section with minimum _____ years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A242/A242M high-strength, corrosion-resistant structural steel.

E. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

F. Steel Plates and Bars: ASTM A572/A572M, Grade 50 (345) high-strength, columbium-vanadium steel.

G. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

H. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

I. Steel Bars: ASTM A108 Grade _____.

J. Steel Plate: ASTM A514/A514M.

K. Pipe: ASTM A53/A53M, Grade B, Finish black.

L. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

M. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.

N. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

O. High-Strength Structural Bolts: ASTM A490 or ASTM A490M; Type 1 alloy steel, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436 washers.

P. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.

Q. Headed Anchor Rods: ASTM F1554, Grade 55, plain.

R. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

S. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107m and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

T. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

U. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate all structural steel.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

C. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating. where required in Drawings.

2.04 SOURCE QUALITY CONTROL

A. Testing and Inspection: Per AISC 14th Edition Chapter "N".

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with 1.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection.

C. Field weld components and shear studs indicated on shop drawings.

D. Do not field cut or alter structural members without approval of Architect.

E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

F. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

END OF SECTION

SECTION 05 3100
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellular floor deck.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.

B. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.

C. Section 05 5000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

F. ASTM E384 - Standard Test Method for Knoop and Vickers Hardness of Materials; 2011.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.

I. FM (AG) - FM Approval Guide; current edition.

J. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.

K. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

L. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

M. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; ICC Evaluation Service, Inc; 2010 (R2013).

N. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc; 2013.

O. ITS (DIR) - Directory of Listed Products; current edition.

P. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

Q. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

R. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

S. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Nucor-Vulcraft Group; Nebraska: www.vulcraft.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

A. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
   2. Structural Properties: as indicated on the Drawings.
   3. Span Design: Single.
   4. Minimum Base Metal Thickness: as indicated on the Structural Drawings.
   5. Nominal Height: as indicated on the Structural Drawings.
   6. Profile: Fluted; SDI NR.
   7. Formed Sheet Width: 24 inch.
   8. Side Joints: Lock seam.
   9. End Joints: fastened as indicated on the Structural Drawings.

2.03 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.

B. Welding Materials: AWS D1.1/D1.1M.

C. Fasteners: Galvanized hardened steel, self tapping.

D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.
   1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
   2. Material: Steel; ASTM A510/A510M, Grade 1077.
      a. Hardness: Rockwell C 54.5, minimum.

E. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
   1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM)SDI design method for roof deck and floor deck applications and ICC-ES AC43.

F. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. Clinch lock seam side laps.

E. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

F. Weld deck in accordance with AWS D1.3/D1.3M.

G. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

H. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

I. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items, including:
   1. Prefabricated ladders and ship ladders.
   2. Guardrails and handrails.
   3. Column caps/coping and steel connection plates.
   4. Miscellaneous steel fabrications.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.

C. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.

D. Section 05 5100 - Metal Stairs.

E. Section 09 9000 - Painting and Coating

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

M. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

P. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, factory primed.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

H. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for finish, transport and delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint factory finish.
   1. Side Rails: as indicated on the drawings.
   2. Rungs: as indicated on the drawings.

3. Space rungs as indicated on the drawings.

B. Bumper Posts and Guard Rails: As detailed; powder coat finish on exterior finish.

C. Joist Hangers: Strap anchors, fabricated with sheet steel, 18 gage, 0.0478 inch minimum base metal thickness; galvanized finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of masonry; prime paint finish for field painting as indicated on the drawings.

E. Lintels: As detailed; prime paint factory finish for field painting as indicated on the drawings.

F. Door Frames for Wall Openings and Louver Openings: Channel sections; prime paint finish.

G. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

H. Guardrails and Handrails: Fabricate out of steel tubes and plates in sizes indicated on drawings. Form layouts as detailed.

I. Column Caps and Connection Plates: Fabricate out of steel plates to form as detailed in drawings.

J. Sump Grating: Fabricate out of galvanized steel plates and angles as detailed in the drawings.

K. Sidewalk and Area Well Trench grating: as indicated on the Drawings.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items as called out in the drawings.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
   3. Exceptions: Do not prime surfaces where powder coat finish is called for on the drawings.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

2.06 ACCESSORIES

A. Bolts, Nuts, Washers, etc.: Provide as needed for locations detailed in drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete and/or scheduled for powder coat finishes.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5100

METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with grating treads.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.02 RELATED REQUIREMENTS (THIS LIST MAY NOT BE ALL INCLUSIVE)

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

B. Section 05 5000 - Metal Fabrications: Handrails in coordination with stairs.

C. Section 09 9000 - Painting and Coating: Paint and Powder Coat finish.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

L. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

M. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

N. ASTM E2072 - Standard Specification for Photoluminescent (Phosphorescent) Safety Markings; 2014.

O. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

R. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

S. ICC (IBC) - International Building Code; 2015.

T. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

U. UL 1994 - Luminous Egress Path Marking Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Samples: Provide samples of powder coat finish.

D. Welders' Certificates.

1.05 QUALITY ASSURANCE

A. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

B. Fabricator Qualifications:
   1. A company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Dimensions: As indicated on drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for powder coat finishing and for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
      a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
      b. Welds Exposed to View: Ground smooth and flush.
      c. Mechanical Joints: Butted tight, flush, and hairline.
      d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
      e. Exposed Edges and Corners: Eased to small uniform radius.
      f. Metal Surfaces to be Powder Coated: Sanded or ground smooth, suitable for Powder Coat finishing process .

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.

B. Risers: Open.

C. Treads: Steel bar grating, as indicated on the drawings.

D. Stringers: As indicated on the drawings.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

F. Railings: Steel pipe railings.

G. Finish: Powder Coated.

2.04 HANDRAILS AND GUARDS

A. Guards:
   1. Top, Bottom and Intermediate Rails: Round pipe or tube rails as indicated on the drawings.
   2. Provide design detailed in drawings.

B. Photoluminescent Handrail Strips: Factory fabricated, field applied strips.

2.05 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Gratings: Bar gratings complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

2.06 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.07 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Paint Steel Items:
   1. Exceptions: Galvanize items as called out on the drawings.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, wher field welding is required, and items to be covered with sprayed fireproofing.
   3. Exceptions: Do not prime surfaces where powder coat finish is called for on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Survey existing building and field conditions to ensure they are as shown on the drawings.

3.02 PREPARATION

A. Supply items required to be cast into concrete with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field welding of Powder Coat finished items is not allowed.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 7000
DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom elevator cab finish metal and handrails.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: plywood backing for attachment of decorative metal.

B. Section 09 9000 - Painting and Coating: metallic powder coat finish.

C. Section 12 3600 - Countertops: plastic laminate and metallic laminates for custom elevator cab.

D. Section 14 2010 - Passenger Elevators: custom elevator cab.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

C. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Samples: 6" x 6" illustrating custom metallic powder coat finish.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover, in a dry location.

1.06 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Elevator Cab Grating:
   1. McNichols.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Steel Components:
   1. Ungalvanized Steel Sheet: Cold-rolled only.
      a. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

2. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
3. Gauge: 20
4. Type: Perforated, decorative
   a. Pattern Name: Grecian Large Pattern.
   b. Percent Open Area: 39.

2.03 ACCESSORIES

A. Handrails:
   1. Size as indicated on the drawings.
   2. Powder coat finish: metallic, color to be selected.

B. Panels:
   1. Factory cut to size.
   2. All panels to have factory installed "U" edging as indicated on the drawings.
   3. Powder coat finish: metallic, color to be selected.

C. Anchors, Fasteners and Stand-Offs: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to plywood.
   2. Exposed Fasteners: As indicated on the drawings.
   3. Powder coat finish: metalllic, color to be selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Coordinate with elevator manufacturer for allowable weight, attachment and other items.

D. Notify Architect immediately of conditions that would prevent satisfactory installation.

E. Do not proceed with work until detrimental conditions have been corrected.

F. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION

A. Field measure for factory assembled panels.

B. Protect existing work.

C. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.

D. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/16 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/16 inch.

C. Maximum Out-of-Position: 1/16 inch.

3.05 CLEANING

A. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.06 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

DIVISION

6

WOOD, PLASTICS, AND COMPOSITES

SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Exposed timber structural framing.

C. Non-structural dimension lumber framing.

D. Rough opening framing for doors, windows, and roof openings.

E. Sheathing.

F. Subflooring.

G. Miscellaneous framing and sheathing.

H. Communications and electrical room mounting boards.

I. Concealed wood blocking, nailers, and supports.

J. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.

B. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.

C. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

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 C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

F. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

J. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

K. ICC (IBC) - International Building Code; 2015.

L. ICC (IECC) - International Energy Conservation Code; 2012.

M. PS 1 - Structural Plywood; 2009.

N. PS 20 - American Softwood Lumber Standard; 2010.

O. SPIB (GR) - Grading Rules; 2014.

P. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber for Non-Load Bearing Interior Partitions: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Western Woods (WCLIB or WWPA), Mixed Southern Pine (SPIB), Eastern Softwoods (NELMA), or Northern Species (NLGA) unless otherwise indicated.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Dimension Lumber for Framing Other Than Non-Load Bearing Partitions: Construction or No. 2 grade and any of the following species; unless otherwise indicated on the Structural Drawings.
   1. Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; NLGA, WCLIB, or WWPA
   2. Gem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA
   3. Southern pine; SPIB
   4. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA

C. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.
   1. Where salvaged lumber is used for structural applications, provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc; www.alsc.org.

2.02 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber and Laminated Strand Lumber: Composite of wood veneers with grain primarily parallel to member lengths, manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.
   1. Available manufacturers:
      a. Weyerhaeuser Company.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2. Exterme Fiber Stress in Bending, Edgewise: 2600 psi for 12-inch nominal-depth members.
3. Modulus of Elasticity, Edgewise: 2,000,000 psi.

B. Wood I-Joists: Prefabricated units complying with APA PRI-400; depths and performance ratings not less than those indicated. Joists other than those indicated must meet all of the structural performance requirements of those indicated. Submit specifications to Engineer.
1. Available manufacturers:
a. Weyerhaeuser Company.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. Web Material: Either oriented strand board or plywood, Exposure 1.
3. Structural Capabilities: Establish and monitor structural capacities according to ASTM D 5055.
4. Trademark: Factory mark I-joists with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and I-joist compliance with APA standard.

2.03 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Grading Agency: Western Wood Products Association; WWPA G-5.

C. Sizes: Nominal sizes as indicated on drawings, S4S.

D. Moisture Content: S-dry or MC19.

E. Stud Framing (2 by 2 through 2 by 6):
1. Species: Hem-Fir (minimum) or as indicated on Structural Drawings.
2. Grade: as indicated on Structural Drawings; No. 2 minimum.

F. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
1. Machine stress-rated (MSR) as follows:
a. Fb-single (minimum extreme fiber stress in bending): 1350 psi.
b. E (minimum modulus of elasticity): 1,300,000 psi.
2. Species: Any allowed under grading rules.
3. Species: Hem-Fir (minimum) or as indicated on Structural Drawings.
4. Grade: As indicated on Structural Drawings.
5. Species and Grades: As indicated on the drawings for various locations.

G. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.04 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
1. Columns: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): as indicated on structural drawings psi, minimum.
2. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): as indicated on structural drawings psi, minimum.
3. Headers Not Longer Than 48 inches: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber.
4. Manufacturers:
a. Weyerhaeuser: www.weyerhaeuser.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: Oriented strand board wood structural panel; PS 2, rated Single Floor.
   1. Performance Category: 19/32 PERF CAT minimum or as indicated on drawings.
   2. Span Rating: 20.
   3. Edges: Square.
   4. Edges: Tongue and groove.
   5. Surface Finish: Fully sanded face.
   6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 200 days.
   7. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.
   8. Manufacturers:
      a. Georgia-Pacific Wood Products LLC; Blue Ribbon OSB Sturd-I-Floor: www.buildgp.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Sheathing: Wood construction panel laminated to insulation board.
   1. Construction Panel: 7/16 inch (11 mm) oriented strand board (OSB).
   2. Insulation Board: Polyisocyanurate foam plastic with cellulosic felt facer or glass fiber mat facer on major surface opposite construction panel.
   3. Finished Panel: Comply with ASTM C1289, Type V.
   4. Manufacturers:
      a. Carlisle Coatings & Waterproofing, Inc; R2+ Base: www.carlisleccw.com/#sle.
      b. Hunter Panels, LLC; Xci Ply: www.hunterxci.com/#sle.
      c. _____.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

E. Sill Flashing: As specified in Section 07 6200.

F. Subfloor Glue: Waterproof, air cure type, cartridge dispensed.
   1. Manufacturers:
      a. Franklin International, Inc; Titebond PROvantage Weatherproof Subfloor Adhesive: www.titebond.com/sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2. Construction Adhesives:
    a. Manufacturers:
        1) Franklin International, Inc; Titebond Fast Set Polyurethane Construction Adhesive: www.titebond.com/sle.
        2) Substitutions: See Section 01 6000 - Product Requirements.

2.07 FACTORY WOOD TREATMENT

A. Preservative Treatment:
    1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
        a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
        b. Treat lumber exposed to weather.
        c. Treat lumber in contact with roofing, flashing, or waterproofing.
        d. Treat lumber in contact with masonry or concrete.
        e. Treat lumber less than 18 inches above grade.
        f. Treat lumber in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and IBC 2015.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Wall paneling and trim.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring: Glue and nail to framing; staples are not permitted.

B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Screw panels to framing; staples are not permitted.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size and Location: As indicated on drawings.

3.06 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.

3.08 CLEANING

A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood trim, mouldings, covers, paneling, and casings.

C. Exposed wood framing members including plywood.

D. Refinishing of existing salvaged wood items including hardwood floors, base, stairs, handrails, balustrades, casing, wainscotts, wood trim and doors.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 08 1433 - Stile and Rail Wood Doors: Field finishing.

C. Section 09 9000 - Painting and Coating: Field finishing of carpentry items.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

F. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2011.

G. WI (CCP) - Certified Compliance Program (CCP); current edition at www.woodworkinstitute.com/certification.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

D. Samples: Submit two samples of finish plywood, 6" by 6" inch in size illustrating wood grain and specified finish. Include samples of new and existing salvaged refinished wood (after refinishing).

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Refinisher Qualifications: Company specializing in refinishing wood products specified in this section with a minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Woodwork Items:
   1. Base, doors, door trim, window trim, casings, handrails, balustrades, stairs, wainscotts, finish wall(s), floors, etc. (including existing salvaged items noted on the drawings for sanding and refinishing)

2.02 LUMBER MATERIALS

A. Hardwood Lumber: white oak species of similar appearance to owner salvaged wood trim, base and doors, smooth sawn, maximum moisture content of 6 percent.

2.03 SHEET MATERIALS

A. Hardwood Plywood: Face species as indicated, plain sawn, veneer core, glue type as recommended for application.
   1. Fire-resistant rated.
   2. Class A rated.
      a. Flame spread index 0-25.
      b. Smoke development index 0-450.

B. Beadboard Paneling:
   1. Square edge
   2. 4 foot x 8 foot panels
   3. 1/4" thickness
   4. Bead configuration: 2 inch center to center beads with W-bead profile

2.04 FASTENINGS

A. Fasteners: Of size and type to suit application; standard finish in concealed locations and stainless steel finish in exposed locations.

2.05 ACCESSORIES

A. Primer: Alkyd primer sealer.

B. Wood Filler: Solvent base, tinted to match surface finish color.

2.06 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 for inspection by the authority having jurisdiction.

2.07 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

3.01 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. Verify lengths and types of existing salvage items will meet quantities of project requirements.
   1. Where quantities do not meet the project requirements, supply new products of similar character.

3.02 SANDING

A. Patch all floor areas with similar salvaged wood prior to sanding.

B. Fill and repair open seams and defects in flooring and other wood with wood filler material prior to sanding. Gain approval of the architect for type and coloring of all filler materials.

C. Sand floor areas after all other trades are finished.

D. Machine-sand all existing salvage wood with heavy power driven sander.
   1. Remove offsets, ridges, cups, paints, stains, and sanding-machine marks that would be noticeable after finishing.
   2. Sand in four step process with progressively finer grade sand paper.
      a. First cut, use 30 grade sandpaper (for flooring areas, the first cut shall be traversed in both directions going with the grain of the flooring).
      b. Follow with 40 grade paper.
      c. Follow with 60 grade paper.
      d. Finish with 100 grade paper.
      e. All cuts should be made with the grain.
         1) Rough or finish sanding on the diagonal will not be permitted.
   3. Particular attention should be given on each finishing cut to completely remove the coarser grit marks from the preceeding cut.

E. For flooring areas: after sanding floor area, screen disk abrade the floor with a rotary buffing machine.

F. For flooring areas: vacuum floor with heavy duty commercial type vacuum and request inspection by the architect of all areas before any finish work.

G. For flooring areas: protect finish sanded floors with

3.03 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.

D. Install components with nails and adhesive as recommended by manufacturer..

E. Install prefinished paneling with full bed contact adhesive applied to substrate.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9000.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 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 06 6100

SOLID SURFACE FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid Surface window sills.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 Joint Sealers: sealant at dissimilar materials.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two samples representative of window sills, 4 x 4 inch in size, illustrating color, texture, and finish.

C. Maintenance Data: Indicate list of approved cleaning materials and procedures required; list of substances that are harmful to the component materials.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Surface Fabrications:
   1. Dupont; Corian, www.dupont.com.
   2. Wilsonart LLC; www.wilsonart.com.
   3. Formica Corporation; www.formica.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Provide finished products having flame spread index of 35 and smoke developed index of 15, when tested in accordance with ASTM E84 in thickness of 1/2 inch. Equivalent Class A finish per the building code.

B. Flammability: Class 1 and A when tested to UL 723.

C. Materials: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction.

D. Resin: Proprietary type, with integral coloring, stain resistant to domestic chemicals and cleaners.

2.03 FABRICATION

A. Fabricate components by adhering together per manufacturer's recommendations to achieve shape and configuration show in drawings in the longest lengths possible without seaming.

B. Radius corners and edges.

C. Fabricate components in shop to greatest extent practical to sizes and shapes indicated.

D. Form joints between components using manufacturer's standard jolint adhesive without conspicuous joints.

E. Ensure no blistering, whitening and cracking of components during forming.

F. Rout and finish component edges to a smoooth, uniform finish. Sand edges smooth. Repair or reject defective or inaccurate work.

G. Ensure surfaces have a uniform finish.

H. Fabrication Tolerances: Variation in component size +/- 1/8".

2.04 FINISH

A. Color: As selected from manufacturer's range of colors for price group D (in Corian) or equivalent from other manufacturers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated prior to commencing work.

B. Verify that joint preparation and affected dimensions are acceptable.

C. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide anchoring devices for installation .

B. Provide templates and rough-in measurements.

3.03 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Align work plumb, level, rigid, and scribed to adjacent finishes.

C. Rigidly anchor to substrate to prevent misalignment.

D. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.

E. Install with no more than 1/8" sag, bow or other variation from a straigh line.

F. Adhere using manufacturer's recommmended adhesive and mounting hardware.

G. Seal between wall and components with joint sealant as specified in Section 07 9005 as applicable.

H. Keep components and hands clean during installation. Remove adhesives, sealants and other stains.

I. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".

3.04 TOLERANCES

A. Maximum Variation From True Dimension: 1/8 inch.

B. Maximum Offset From True Position: 1/8 inch.

3.05 CLEANING

A. Remove adhesive and sealant from visible surfaces.

B. Clean and polish surfaces in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Do not permit construction near unprotected surfaces.

B. Protect to prevent physical damage and staining following installation for duration of project.

END OF SECTION

DIVISION

7

THERMAL AND MOISTURE PROTECTION

SECTION 07 1113

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous or Water-based dampproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 31 2323 - Fill.

C. Section 07 2100 - Thermal Insulation: Rigid insulation board used as protection board.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.

B. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 2003 (Reapproved 2014).

C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).

D. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.

E. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

F. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bituminous Dampproofing Manufacturers:
   1. Mar-Flex Systems, Inc; _____: www.mar-flex.com/sle.
   2. W.R. Meadows, Inc; _____: www.wrmeadows.com/sle.
   3. Deco Products, Inc.; Deco 20 Dampproof Coating: www.decoproducts.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
   2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.

4. Applied Thickness: 1/16 inch, minimum, wet film.
5. Products:
    a. W.R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com/sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

B. Water-based dampproofing material may be submitted for approval in substitution of asphaltic material, see manufacturer list above for products already approved.

C. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.03 COLD ASPHALTIC MATERIALS

A. Bitumen: Emulsified asphalt, 1;unreinforced (Type III).

B. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

C. Sealing Mastic: Asphalt roof cement, 1, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Apply two coats of dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

E. Apply bitumen with roller.

F. Apply from 2 inches below finish grade elevation down to top of footings.

G. Seal items watertight with mastic, that project through dampproofing surface.

H. Place protection board or insulation directly over dampproofing as indicated on the drawings, butt joints, and adhere to tacky dampproofing.

I. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 07 1300
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet Waterproofing:
   1. Self-adhered modified bituminous sheet membrane.

B. Below-grade waterproofing accessories.

1.02 RELATED REQUIREMENTS (THIS LIST MAY NOT BE ALL INCLUSIVE)

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.

D. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2010).

F. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test) ; 2008.

G. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.

H. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 1993 (Reapproved 2014).

I. ASTM D6134 - Standard Specification for Vulcanized Rubber Sheets Used in Waterproofing Systems; 2007 (Reapproved 2013).

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

K. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2013).

L. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MEMBRANE MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch, minimum.
   2. Sheet Width: 36 inch, minimum.
   3. Tensile Strength:
      a. Film: 5000 pounds per square inch, minimum, measured according to ASTM D882 and at grip-separation rate of 2 inches per minute.
      b. Membrane: 325 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
   4. Elongation at Break: 300 percent, minimum, measured according to ASTM D412.
   5. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.
   6. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
   7. Peel Strength: 7 pounds per inch, minimum, when tested according to ASTM D903.
   8. Lap Adhesion Strength: 5 pounds per inch, minimum, when tested according to ASTM D1876.
   9. Puncture Resistance: 50 pounds, minimum, measured in accordance with ASTM E154/E154M.
   10. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
   11. Hydrostatic Resistance: Resists the weight of 200 feet when tested according to ASTM D5385/D5385M.
   12. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   13. Manufacturers:
      a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.
      b. W.R. Meadows, Inc; MEL-ROL: www.wrmeadows.com/#sle.
      c. Deco Products, Inc.; Deco 20 Seal Waterproofing Membrane: www.decoproducts.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Sealant: As recommended by membrane manufacturer.

2.02 ACCESSORIES

A. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Hardboard, 1/8 inch thick.

B. Protection Board: Type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Use one of the following:
      a. Hardboard, 1/8 inch thick.
      b. Asphalt impregnated wood fiberboard, 1/4 inch thick.
      c. Polystyrene foam board, 1 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - PROTECTION BOARD

A. Place protection board directly against membrane; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.

B. Adhere protection board to substrate with compatible adhesive.

3.05 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at exterior perimeter wall furring.

B. Batt insulation and vapor retarder in exterior roof/attic construction.

C. Batt insulation for filling stud spaces in a sound wall.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.

B. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

D. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Verify that all penetrations through insulation with integral vapor retarder are sealed tight to provide complete system for weather barrier and continuous insulation per the Energy Code.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Exterior Perimeter Wall Furring: Polyisocyanurate board.

B. Insulation in Interior Wood Framed Walls: Sound batt insulation with no vapor retarder.

C. Insulation in Exterior Attic/Roof Construction: Batt insulation with vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Polyiscoyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289, Class 1, non-reinforced foam.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 48 by 96 inch.
   4. Board Thickness: As indicated on drawings.
   5. Thermal Resistance: R-value per inch of 6.5
   6. Board Edges: Square.
   7. Manufacturers:
      a. Dow Chemical Co; Thermax (ci) Exterior Insulation: www.dowbuildingsolutions.com.
      b. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/sle.

c. Johns Manville; AP Foil-Faced: www.jm.com/sle.
d. Owens Corning Corp: www.owenscorning.com

8. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
4. Thermal Resistance: R-value as indicated on the drawings.
5. Facing: Aluminum foil, flame spread 25 rated; one side.
6. Acoustical type for sound walls:
a. In thickness to fill wall cavity.

2.04 ACCESSORIES

A. Tape: On exterior perimeter wall locations use: Woven polypropylene film with a butyl rubber adhesive, self-sealing, self-healing, fully adhered flashing that meets AAMA 711 standard.
1. Product: Dow, Weathermate Straight Flashing, www.dowbuildingsolutions.com
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation Fasteners: Appropriate for purpose intended approved by manufacturer.
1. Length as required for thickness of insulation material and penetration of deck substrate.

C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners. Tape all joints and penetrations with manufacturer's minimum 4 inch wide sealant tape; comply with ASTM E2357.

B. Install boards horizontally on walls.
1. Install in running bond pattern.
2. Butt edges and ends tightly to adjacent boards and to protrusions.
3. Make sure shiplap board edges are postitioned to direct water to the exterior of the wall.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BATT INSTALLATION

A. Install in exterior attic/roof spaces without gaps or voids. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

D. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

F. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over member face.

G. Tape seal tears or cuts in vapor retarder.

H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.05 FIELD QUALITY CONTROL

A. PROTECTION

1. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. At locations as indicated on the drawings to seal openings at soffit and attic.

B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:
   1. Dow Building Solutions; Product Styrofoam Brand Spray Polyurethane Foam (CM series) www.dowbuildingsolutions.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Aged Thermal Resistance: R-value of 5 (deg F hr sq ft)/Btu, minimum, when tested at 1 inch thickness in accordance with ASTM C518 after aging for 180 days at 41 degrees F.
   2. Water Vapor Permeance: Vapor retarder; 2 perm, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
   3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.

4. Closed Cell Content: At least 90 percent.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Overcoat: Intumescent type, spray applied; flame spread index of 0-25 and smoke developed index of 0-450, when tested in accordance with ASTM E84.
   1. Product: As recommended by Foamed-in-Place Insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply to achieve complete and continuous seal of openings in attic soffit from infestation of birds, bats, and other insects.

D. Apply overcoat monolithically, without voids to fully cover foam insulation to achieve flame spread index and smoke development index required.

E. Patch damaged areas.

F. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

G. Trim excess away for applied trim or remove as required for continuous sealant bead.

H. Apply to fill spaces between and around beams and structural items, especially at head of wall to roof connection in the attic to provide a continous seal to prevent bird, bat, and other insect entry.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

3.05 SCHEDULES

A. Schedule the work of this section at the start of the project and monitor for effectiveness through the duration of the project to completion.

END OF SECTION

SECTION 07 3113
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Flexible sheet membranes for eave protection and underlayment.

C. Associated metal flashings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roof sheathing.

1.03 REFERENCE STANDARDS

A. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2016.

B. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2010a.

C. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012.

D. ICC-ES AC207 - Acceptance Criteria for Polypropylene Roof Underlayments; 2012.

E. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating material characteristics.

C. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern for verification.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with the recommendations of shingle manufacturer.

B. Products are Required to Comply with Fire Resistance Criteria: UL (DIR) listed and labeled.
   1. Listed Class A fire - UL 790.

1.06 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Asphalt Shingles:
   1. GAF; Timberline Ultra HD: www.gaf.com/sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462.
   1. Fire Resistance: Class A.
   2. Warranted Wind Speed: 130 mph.
   3. Self-sealing type.
   4. Color: Hickory.

2.03 SHEET MATERIALS

A. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
   1. Type as recommended by asphalt shingle manufacturer.

B. Ice and Water Sheild Flexible Flashing: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

2.04 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 10 wire gage, 0.1019 inch shank diameter, 3/8 inch head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking or as recommended by shingle manufacturer.

2.05 METAL FLASHINGS

A. Metal Flashings: Provide sheet metal eave edge, chimney flashing, and other flashing indicated.
   1. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
   2. Verify with existing stone.
   3. Coat concealed surfaces of flashings with bituminous paint.

B. Steel Sheet Metal: Prefinished and galvanized steel sheet, 26 gage, 0.0179 inch minimum thickness, G90/Z275 hot-dipped galvanized; PVC coated, brown color.

C. Bituminous Paint: Acid and alkali resistant type; brown color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 6 inches on center.

3.03 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

C. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.04 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.

1. Fasten shingles using the amount of nails per shingle as recommended by the manufacturer.

B. Project first course of shingles 1/2 inch beyond fascia boards.

C. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

D. After installation, place one daub of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.

E. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

F. Complete installation to provide weather tight service.

END OF SECTION

SECTION 07 7123

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 6 inch long illustrating component design, finish, color, and configuration.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch thick.
   1. Color: To match tan color of existing stone.

2.02 COMPONENTS

A. Gutters and Downspouts: Profile as indicated on the drawings.

B. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with CDA requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

C. Fasteners: Galvanized steel, with soft neoprene washers.

2.03 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.04 FINISHES

A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; custom color to match approved sample.

B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Slope gutters 1/16 inch per foot.

D. Connect downspouts to storm sewer system. Seal connection watertight.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

D. ITS (DIR) - Directory of Listed Products; current edition.

E. FM (AG) - FM Approval Guide; current edition.

F. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

G. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

I. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years documented experience installing work of this type.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc.: www.adfire.com.
   2. 3M Fire Protection Products: www.3m.com/firestop.

3. Hilti, Inc: www.us.hilti.com/#sle.
4. Nelson FireStop Products: www.nelsonfirestop.com.
5. Specified Technologies, Inc.: www.stifirestop.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Firestopping Materials: Any materials meeting requirements.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required ratings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. Precompressed foam sealers.

C. Hollow gaskets.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast In Place Concrete: Joints in exposed architectural concrete.

B. Section 07 8400 - Firestopping: Firestopping sealants.

C. Section 08 5123 Steel Windows: Perimeter sealant.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

E. Section 09 2116 - Gypsum Board Assemblies: Joint sealant.

F. Division 22 - Plumbing: Sealant at plumbing fixtures

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

G. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991 (Reapproved 2011).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, and color availability.

C. Samples: Submit chart illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures and surface preparation.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gunnable and Pourable Sealants:
   1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   2. Bostik Inc: www.bostik-us.com.

3. ARDEX Engineered Cements: www.ardexamericas.com.
4. Dow Corning Corporation: www.dowcorning.com.
5. Tremco Global Sealants: www.tremcosealants.com.
6. Sika Corporation: www.usa-sika.com.
7. W.R. Meadows, Inc: www.wrmeadows.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Preformed Compressible Foam Sealers:
1. EMSEAL Joint Systems, Ltd: www.emseal.com.
2. Dayton Superior Corporation: www.daytonsuperior.com.
3. Tremco Global Sealants: www.tremcosealants.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS

A. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.

B. Exterior Expansion Joint Sealer: ASTM D2628, hollow neoprene (polychloroprene) compression gasket.

C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Color: To be selected by Architect from manufacturer's standard range.

D. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Applications: Use for:
a. Joints between plumbing fixtures and floor and wall surfaces.
b. Joints between kitchen and bath countertops and wall surfaces.

E. Acoustical Sealant for Concealed Locations:
1. Composition: Acrylic latex emulsion sealant.
2. Applications: Use for concealed locations only:
a. At joints in soundproof wall separations.

F. Epoxy - Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Single or multi-part,100 percent solids by weight.
2. Hardness: 85 after 7 days, when tested in accordance with ASTM D2240 Shore A.
3. Color: To be selected by Architect from manufacturer's standard colors.

G. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
1. Color: Gray.
2. Applications: Use for:
a. Joints in sidewalks.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

E. Exposed Concrete Floor Joints: Test joint filler in inconspicuous area of floor slab. Verify specified product does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

K. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

DIVISION

8

OPENINGS

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

E. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).

F. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

G. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

L. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

N. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

Q. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

R. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.

S. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

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W. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

X. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Z. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 inch by 6 inches in size showing factory surface texture (of wood embossing).

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

B. Storage of Doors:
   1. Doors shall be stored in an upright position under cover. Place the units on at least 4" wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. If the corrugated wrapper on the door becomes wet, or moisture appears, remove the wrapper immediately. Provide a space 4” between the doors to promote air circulation. Proper storage is required to meet the requirements of ANSI/SDI A2501.0.

C. Storage of Frames:
   1. Frames shall be stored in an upright position with heads uppermost under cover on 4" wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. Assembled frames shall be stored in a vertical position, five units maximum in a stack. Provide a 2” space between frames to promote air circulation. Proper storage is required to meet the requirements of ANSI/SDI A2501.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com
   3. Republic Doors: www.republicdoor.com.
   4. Steelcraft, an Allegion brand: www.allegion.com/us.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior and Interior: Typical Door Face Sheets: Flush and Embossed with wood grain. as indicated on the drawings.
   4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Security.
      a. Insulated glass units at exterior locations.
      b. Between glass muntins as indicated on the drawings.
   5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

B. Hollow Metal Frames: Same construction, performance, and finish as doors.
   1. Grout frames solid at exterior locations.

C. Fabricate to conform to ANSI/SDI A250.8. Provide reinforcement as specified.

D. Frames shall be supplied set up and welded with faces welded and ground smooth. Miters of frames shall be back welded. Weld shall penetrate the outside face. Faces shall be dressed smooth and prime painted. Filler materials are not permitted.

E. Provide two temporary steel spreaders (welded to the jambs at each rabbet of door openings) on welded frames during shipment.

F. Doors: Hinge reinforcements shall be 7 gage for 1-3/4" doors. Lock reinforcements shall be 16 gage and closer reinforcements 14 gage - box minimum 6” high and 20" long. Hinge and lock reinforcements shall be projection welded to the edge of the door. Galvannealed doors shall have galvannealed hardware reinforcements. Adequate reinforcements shall be provided for other hardware as noted in ANSI/SDI A250.6. Hardware preparation shall be in accordance with A115 standards.

G. Frames for 1-3/4" doors shall have 7 gage universal steel hinge reinforcements prepared for standard or heavy weight template hinges. Strike reinforcements shall be 16 gage and prepared for the strike. Reinforcements for surface closer shall be 14 gage steel. Adequate reinforcements shall be provided for other hardware as noted in ANSI/SDI A250.6. Hardware preparation shall be in accordance with A115 standards.

H. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. Model as indicated on the drawings.
d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.
4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
5. Weatherstripping: Refer to Section 08 7100.
6. Galvanized.

C. Interior Doors, Non-Fire Rated as indicated on the drawings:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.

D. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
a. Provide units listed and labeled by UL (DIR).
b. Attach fire rating label to each fire rated unit.
3. Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inch, nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Fully back welded at embossed wood grain locations.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
2. Frame Finish: Factory primed and field finished.

D. Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
3. Frame Finish: Factory primed and field finished.

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.

B. Astragals for Double Doors: Specified in Section 08 7100.

C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Doors and frames shall be installed in accordance with ANSI/DHI A115.IG and ANSI/SDI A250.11 and in accordance with the manufacturer’s printed installation instructions.

D. Frames shall be installed plumb, level, rigid and in true alignment as recommended in ANSI/SDI A250.11 and A115.IG.

E. Remove temporary steel spreaders prior to installation of the frame.

F. Coordinate frame anchor placement with wall construction.

G. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

H. Install door hardware as specified in Section 08 7100.

I. Comply with glazing installation requirements of Section 08 8000.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with 1 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 1433

STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors, stile and rail design; and frames/jambs; fire rated and non-fire rated.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Existing salvaged and new wood door trim and existing doors salvage for reuse.

B. Section 08 1113 - Hollow Metal Doors and Frames.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing.

E. Section 09 9000 Painting and Coating: Field finishing.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. AWMAC (GIS) - Guarantee and Inspection Services Program; current edition at www.awmac.com/gis.php.

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

F. ICC (IBC) - International Building Code; 2015.

G. ITS (DIR) - Directory of Listed Products; current edition.

H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

I. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

J. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

K. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

M. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate stile and rail 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.

E. Samples: Submit two samples of door veneer, 6 x 6 inch in size illustrating wood grain, stain color, and sheen.

F. Samples: Sumbit two samples of light opening moldings 6 inches long for each material, type an finish required.

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.

C. Quality Certification:
   1. Certified finish carpenter.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors and frames in accordance with quality standard specified.

B. Protect doors and frames 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.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

D. Warranty shall also include installation and finishing that may be required due to repair and/or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stile and Rail Wood Doors and Wood Frames/Jambs:
   1. Aspiro Series, Marshfield-Algoma by Masonite Architectural
   2. Assa Abloy
   3. Trustile
   4. Eggers Industries; ____: www.eggersindustries.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES/JAMBS

A. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Doors: 1-3/8 inches thick; veneer and lumber stile and rail construction; mortise and tenon joints. Prepare for field finish.

2.03 DOOR PANEL AND FRAME/JAMB FACINGS

A. Veneer Facing for Transparent Finish: white oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Veneer clad construction is acceptable.
   2. Ceramic core as needed to comply with fire rating requirements.

B. Adhesive: Type I - Waterproof.

2.04 COMPONENTS

A. Glazing: As specified in Section 08 8000.

B. Panel or Glass Retention Molding: Wood of same species as door facing, molded stop applied one-side,mitered corners; prepared for countersink style tamper proof screws.

C. Door Hardware: As specified in Section 08 7100.

2.05 DOOR CONSTRUCTION

A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Bond edge banding to cores.

D. Panels: Raised.

E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

G. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

H. Fire Rated Doors: Ceramic core type, with fire resitant composite core, plies and faces as indicated with core blocking as required to provide adequate anchorage of hardware without through-bolting.

I. Smoke and Draft Control Doors: In addition to required fire rating, provide stile and rail door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch w.g. pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.

2.06 FIELD FINISHING

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

B. Field Finish frames same as doors in accordance with Section 09 9000 Painting and Coating.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standards.

B. Note: floors in existing buildings may not be level. Survey and identify lowest floor level on floor and set door height with remaining doors on floor level to match door height. Trim bottoms off remaining doors where floor height increases.

C. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Machine cut for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit, clearance, and joinery tolerances.

B. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 x 84 inch surface area.

C. Telegraphing of core construction in face veneers exceeding 0.01 inch in 3 inch span.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and Ceiling access door and frame units (locations and quantities not shown on drawings).

1.02 RELATED REQUIREMENTS (THIS LIST MAY NOT BE ALL INCLUSIVE)

A. Section 09 2116 - Gypsum Board Assemblies: Installation in ceilings and walls.

B. Section 09 9000 - Painting and Coating: Finishing of access doors.

C. Mechanical components requiring access.

D. Electrical components requiring access.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Ceilings and Walls.
   1. Locations: as necessitated for mechanical and electrical access (locations are not shown on the drawings, coordinate with mechanical and electrical).
   2. Material: Steel.
   3. Size: As required for access.
   4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   5. Tool-operated spring or cam lock; no handle.
   6. Provided fire-rated units where required in fire rated locations.

2.02 WALL AND CEILING MOUNTED UNITS

A. Manufacturers:
   1. ACUDOR Products Inc: www.acudor.com/#sle.
   2. Babcock-Davis; _____: www.babcockdavis.com/#sle.
   3. Cendrex, Inc: www.cendrex.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
   2. Door Style: Single thickness with rolled or turned in edges.
   3. Frames: 16 gage, 0.0598 inch, minimum thickness.

4. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
5. Steel Finish: Primed.
6. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    c. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 5123
STEEL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory finished steel windows with fixed sash.

B. Factory-installed glazing .

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA101/I.S.2/A440-08 - North American Fenestration Standard / Specification for windows, doors and skylights; 2008.

B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

D. NFRC - National Fenestration Rating Council certification.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, fasteners, anchors, and glass.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work; installation requirements.

D. Samples: Submit two samples of metal window frame, 6 inch in size, illustrating window frame section, mullion section, and finish surfaces.

E. Touch up paint for owners maintenance.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing windows specified in this section, with not less than fifteen years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience and approved by manufacturer.

C. Window must have independent lab testing in accordance with AAAMA/WDMA/CSA101.I.S.2/A440-08.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturers 2 year warranty for workmanship and materials.

C. Provide manufacturers 10 year insulating glass warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Windows:
   1. Dynamic Architectural Windows & Doors, 30440 Progressive Way, Abbotsford BC, Canada.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL WINDOWS

A. Steel Windows: Cold rolled steel sections, factory fabricated, factory finished, with vision glass, related flashings, anchorage and attachment devices.
   1. Integral true thermal broke frame and sash on all four sides.
   2. Corners mitered welded, then ground to a smooth finish.
   3. Windows include finished to match aluminum square stop, shipped in long linear lengths for site cutting and installation.
   4. Windows: fixed.
   5. Profile: narrow.
   6. Finish: AAMA 2604 comliant factory applied finish: color to match existing replacement windows, field verify.
   7. Fasteners: non-ferrous metal.

2.03 GLASS AND GLAZING MATERIALS

A. Glass: Dual glazed Cardinal 272 Low E tempered exterior pane / clear tempered interior pane.
   1. Ultra voilet protected glazing.
   2. All glass tempered.
   3. 18mm Lead Glass Overlay on Surface #1 and #4 with internal simulated divided lites, metal mutin grid as indicated on the drawings.
      a. Adhesive lead muntins on exterior glass (side 1) & Interiro pane (side 4) of the insulating glass with an aluminum internal grid between the glass surfaces, width to match existing replacement windows.
   4. Includes black spacer bar.
   5. Capillary Tubes: High altitude type.
   6. Glazing Stops: Factory finished aluminum.
   7. U-Value: 0.35
   8. Condensation Resistance: 47.

2.04 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush and hairline.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners to conceal from view.

E. Provide internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

F. Factory-glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining materials are ready to receive work of this section.

B. Field verify overall window dimensions (nominal dimensions are listed on the drawings).

3.02 INSPECTION

A. Windows to be blanket wrapped for delivery to protect finish.

3.03 INSTALLATION

A. Install window frames and glass and glazing in accordance with manufacturers instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install glass and infill panels in accordance with Section 08 8000, to glazing method required to achieve performance criteria.

E. Care is to be taken in handling and placement of windows to avoid damaging the finish.

F. Secure window frames securely to surrounding construction with fasteners supplied.

3.04 CLEANING

A. Remove protective material from factory finished surfaces.

B. Remove labels and visible markings.

C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

D. Remove excess glazing sealant by method acceptable to sealant manufacturer.

3.05 PROTECTION

A. Do not permit continuing construction activities near unprotected finish surfaces.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood 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.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 1433 - Stile and Rail Wood Doors.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

D. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

E. BHMA A156.3 - American National Standard for Exit Devices; 2014.

F. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

G. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.

H. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.

I. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2012.

J. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

K. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

L. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

M. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

O. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Owner's keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

D. Keying Schedule: Submit for approval of Owner.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for door closers.

PART 2 PRODUCTS

2.01 HINGES

A. Hinges: Provide hinges on every swinging door.
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.
   3. Four Hinges: For doors with heights 91 to 120 inches.
   4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

B. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   1. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   2. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

C. 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   1. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   2. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

D. 4. Hinge Options: Comply with the following:
   1. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

E. 5. Acceptable Manufacturers:

1. Hager Companies (HA).
2. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
3. Ives (IV).

2.02 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
   1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
   2. Furnish dust proof strikes for bottom bolts.
   3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
   4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
   5. Acceptable Manufacturers:
      a. Ives (IV).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

2.03 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
   1. Acceptable Manufacturers:
      a. Sargent Manufacturing (SA).
      b. Yale Locks and Hardware (YA).

C. Cylinders: Original manufacturer cylinders complying with the following:
   1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
   2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
   4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
   5. Keyway: Manufacturer’s Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
   3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Three (3).
   2. Master Keys (per Master Key Level/Group): Five (5).
   3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):
   1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
   2. Provide transcript list in writing or electronic file as directed by the Owner.

2.04 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified.
   1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) - 7900 Series.
b. Yale Locks and Hardware (YA) - 8800FL Series.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.
1. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
2. Locks are to be non-handed and fully field reversible.
3. Acceptable Manufacturers:
a. Sargent Manufacturing (SA) - 10 Line.
b. Yale Locks and Hardware (YA) 5400LN Series.

2.05 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.06 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
a. Sargent Manufacturing (SA) - 80 Series.
b. Yale Manufacturing (YA) - 7000 Series.

2.07 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Acceptable Manufacturers:
a. Sargent Manufacturing (SA) - 351 Series.
b. Norton Door Controls (NO) - 7500 Series.

C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Acceptable Manufacturers:
a. Norton Door Controls (NO) - 8500 Series.
b. Sargent Manufacturing (SA) - 1431 Series.

2.08 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to

accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Acceptable Manufacturers:
    a. LCN Door Closers (LC) - SEM7800 Series.
    b. Rixson (RF) - 980/990 Series.
    c. Sargent Manufacturing (SA) - 1560 Series.

2.09 ARCHITECTURAL TRIM

A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
    a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Acceptable Manufacturers:
    a. Ives (IV).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

2.10 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
1. Acceptable Manufacturers:
    a. Ives (IV).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
1. Acceptable Manufacturers:
    a. Rixson Door Controls (RF).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Sargent Manufacturing (SA).

2.11 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and

provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:
   1. National Guard Products (NG).
   2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
   3. Reese Enterprises, Inc. (RE).

PART 3 EXECUTION

3.01 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.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Do not install surface mounted items until finishes applied to substrate are complete.

D. Mounting heights for hardware from finished floor to center line of hardware item. As indicated in the following list; unless noted otherwise in Door Hardware Sets Schedule or on the drawings.
   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 exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.06 SCHEDULE

HARDWARE SETS

4.01 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Manufacturer's Abbreviations:
    a. 1. MK - McKinney
    b. 2. RO - Rockwood
    c. 3. SA - Sargent
    d. 4. RF - Rixson
    e. 5. NO - Norton
    f. 6. PE - Pemko

HARDWARE SETS: SEE ATTACHED HARDWARE SETS.

END OF SECTION

Hardware Sets

Set: A
Doors: S03

3	Hinge (heavy weight)	T4A3386 (NRP)	US32D	MK
1	Rim Exit Device, entrance	21 8813 ETL GMK	US32D	SA
1	Surface Closer	CPS7500	689	NO
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Threshold	273x3AFG		PE
1	Gasketing	2893AV		PE
2	Gasketing	2903AV		PE
1	Door Bottom	216BDCFG		PE

Set: B
Doors: S04

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	21 28 10G04 LL GMK	US26D	SA
1	Surface Closer	(P)8501	689	NO
1	Door Stop	406/409/441CU as required	US32D	RO
1	Acoustic Corner Pad	ACP112BL/2		PE
1	Smoke Gasketing	S88D		PE
1	Door Bottom	PDB411AE		PE

Set: C
Doors: S05

6	Hinge	TA2714 (NRP)	US26D	MK
2	Surface Bolt	585-12	US26D	RO
1	Storeroom Lock, 3/4" latch	21 28 41 10G04 LL GMK	US26D	SA
2	Conc Overhead Stop	1-X36	630	RF
2	Surface Closer	(P)8501	689	NO
2	Acoustic Corner Pad	ACP112BL/2		PE
1	Sound Seal	332CR		PE
2	Door Bottom	PDB411AE		PE
2	Meeting Stile Seal	305CN		PE

Set: D
Doors: 001

6	Hinge (heavy weight)	T4A3386 (NRP)	US32D	MK
1	CVR Exit Device, pull	MD8610 862	US32D	SA
1	CVR Exit Device, pull & cyl	21 MD8610 106 x 862 GMK	US32D	SA
2	Surface Closer	CPS7500	689	NO
2	Closer Drop Plate	7788 as required	689	NO
1	Threshold	273x3AFG		PE
1	Gasketing	2893AV		PE
2	Gasketing	2903AV		PE
2	Door Bottom	216BDCFG		PE
2	Meeting Stile Seal	305CN		PE

Set: E
Doors: 003

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Fire Exit Hardware, entrance	12 21 8813 ETL GMK	US32D	SA
1	Surface Closer	(P)8501	689	NO
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Electromagnetic Holder	998M	689	RF
1	Acoustic Corner Pad	ACP112BL/2		PE
1	Smoke Gasketing	S88D		PE
1	Door Bottom	PDB411AE		PE

Notes: Door is normally held open on wall magnet, which is tied to the fire alarm system and releases upon loss of power, allowing the fire door to close and latch.

Set: F
Doors: E03

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Storeroom Lock	21 7904 COMT GMK	US26D	SA
1	Surface Closer	(P)8501	689	NO
1	Door Stop	406/409/441CU as required	US32D	RO
1	Acoustic Corner Pad	ACP112BL/2		PE
1	Smoke Gasketing	S88D		PE
1	Door Bottom	4131CRL		PE

Set: G
Doors: 010, S01

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	21 7904 COMT GMK	US26D	SA
1	Surface Closer	(P)8501	689	NO
3	Silencer	608-RKW		RO

Set: H
Doors: 005

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Rim Exit Device, entrance	21 8813 ETMT GMK	US32D	SA
1	Surface Closer	CPS7500	689	NO
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Threshold	273x3AFG		PE
1	Gasketing	2893AV		PE
2	Gasketing	2903AV		PE
1	Door Bottom	216BDCFG		PE

Set: J
Doors: 019

3	Hinge (heavy weight)	T4A3386 (NRP)	US32D	MK
1	Storeroom Lock	21 28 10G04 LL GMK	US26D	SA
3	Silencer	608-RKW		RO

Set: K
Doors: 101, 201

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
3	Swing Clear Hinge	T4A3795	US26D	MK
2	SVR Fire Exit HW, entrance	12 21 NB8713 ETMT GMK	US32D	SA
2	Surface Closer	(P)8501	689	NO
2	Kick Plate	K1050 10" BEV CSK	US32D	RO
2	Electromagnetic Holder	998M	689	RF
2	Acoustic Corner Pad	ACP112BL/2		PE
1	Smoke Gasketing	S88D		PE
2	Door Bottom	PDB411AE		PE
2	Meeting Stile Seal	305CN		PE

Notes: Doors are normally held open on wall magnets, which are tied to the fire alarm system and release upon loss of power, allowing the fire doors to close and latch.

Set: L
Doors: 017B

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	21 7904 COMT GMK	US26D	SA
1	Surf Overhead Stop	9-X36	630	RF
1	Threshold	271A		PE
1	Gasketing	294AV		PE
1	Sweep	315CN		PE

Set: M
Doors: 007, 012, 013, 017A

3	Hinge	TA2714 (NRP)	US26D	MK
1	Office Lock	21 7955 COMT GMK	US26D	SA
1	Surface Closer	(P)8501	689	NO
1	Door Stop	406/409/441CU as required	US32D	RO
3	Silencer	608-RKW		RO

Set: N
Doors: 102

3	Hinge	TA2714 (NRP)	US26D	MK
1	Office Lock	21 7955 COMT GMK	US26D	SA
1	Door Stop	406/409/441CU as required	US32D	RO
3	Silencer	608-RKW		RO

Set: P
Doors: 105, 107

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	21 7904 COMT GMK	US26D	SA
3	Silencer	608-RKW		RO

Set: Q
Doors: 110, 209

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Rim Exit Device, entrance	21 8813 ETMT GMK	US32D	SA
1	Surface Closer	(P)8501	689	NO
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Threshold	271A		PE
1	Smoke Gasketing	S88D		PE
1	Sweep	315CN		PE

END HARDWARE SETS

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: existing salvaged interior door components with requirement for glass.

B. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

C. Section 08 1433 - Stile and Rail Wood Doors: Glazed lites in doors.

D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

E. Section 08 5123 - Steel Windows: Glazing furnished by window manufacturer.

F. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1036 - Standard Specification for Flat Glass; 2011.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

I. GANA (GM) - GANA Glazing Manual; 2009.

J. GANA (SM) - GANA Sealant Manual; 2008.

K. ICC (IBC) - International Building Code; 2015.

L. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

N. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 4 by 4 inch in size of obscure glass for selection.

E. Certificates: Certify that products meet or exceed specified requirements.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.
   2. To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapor retarder and air barrier seal.
   3. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.02 INSULATING GLASS UNITS

A. Insulating Glass Units: Types as indicated.
   1. Provide same exterior glazing type as indicated for exterior steel framed windows as specified in Section 08 5123.
   2. Muntin Color: to be selected.
   3. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
      a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.

2.03 BASIS OF DESIGN - PATTERNED (OBSCURE) GLASS

A. Basis of Design - Patterned Glass: Cast or molded glass; translucent, showing shadows but not form.
   1. Applications: Locations as indicated on drawings.
   2. Style: As selected by Architect from manufacturers standard line.
   3. Tint: Clear.

4. Glass Type: Fully tempered.
5. Thickness: As indicated on the drawings.

2.04 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.05 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color clear.

D. Glazing Clips: Manufacturer's standard type.

E. Between Glass Muntins: standard type for hollow metal insulating glass units.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed - Existing salvage steel frame window units: Set glazing infills from the interior of the room.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

DIVISION

9

FINISHES

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Smooth finish system.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Building framing.

B. Section 07 2100 - Thermal Insulation: Acoustic insulation.

C. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.

D. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

E. Section 09 9000 - Painting and Coating: Finish on drywall surface.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

E. 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.

F. 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.

G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

L. ASTM E413 - Classification for Rating Sound Insulation; 2010.

M. GA-216 - Application and Finishing of Gypsum Board; 2013.

N. GA-600 - Fire Resistance Design Manual; 2015.

O. ICC (IBC) - International Building Code; 2015.

P. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on shaft wall stud framing members.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches minimum in size, illustrating finish texture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
   1. Fire Rated Partitions and Shaft Walls: UL or GA listed assemblies as indicated on the drawings.
   2. Fire Rated Ceilings and Soffits: One (1) hour fire rating.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Phillips Manufacturing Company: www.phillipsmfg.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Ceiling Channels: C-shaped.
   2. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754.
   1. Products:
      a. Same manufacturer as other framing materials.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com.
   4. National Gypsum Company; ____: www.nationalgypsum.com/#sle.
   5. USG Corporation: www.usg.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required where indicated on the drawings.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.

C. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered.
   4. Products:
      a. Same as for Wallboard.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
   1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2.04 ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 2100.

B. Acoustic Sealant: As specified in Section 07 9005 Joint Sealers.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   3. Products:
      a. Same manufacturer as framing materials.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners.
   2. Ready-mixed vinyl-based joint compound.
   3. Chemical hardening type compound.

E. Textured Finish Materials: Latex-based compound; plain.

F. 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.

G. 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 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.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

3.03 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.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

D. Acoustic Furring: Install resilient channels at maximum 16 inches on center. Locate joints over framing members.

3.04 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. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 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 in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

F. Installation on Wood Framing:
   1. Single-Layer Applications: Screw attachment.

3.06 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.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5 (smooth troweled): Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction as indicated on the drawings.

C. 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.

D. 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.

3.08 TEXTURE FINISH

A. Apply smooth finish coating by means of trowel in accordance with manufacturer's instructions.

3.09 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 09 3000

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Tile accessories and trim.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: existing and new subflooring for floor tile.

B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2013.1.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.

C. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

D. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

E. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

F. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

G. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).

H. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

I. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).

J. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

K. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

L. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.

M. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Provide two samples of each tile size illustrating color and pattern finish and samples of available grout colors.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 percent of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up, incorporating all components specified for the location.
   1. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Glazed Wall Tile:
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Size: 3 by 6 inch, nominal.
   3. Edges: Square.
   4. Surface Finish: High gloss.
   5. Color(s): To be selected by Architect from manufacturer's standard range.
   6. Listello: White Shelf Rail as indicated on the drawings.
   7. Products:
      a. Daltile: Rittenhouse Square.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Porcelain Tile, Type Glazed Mosaic: _____.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   2. Size: 2 by 2 inch, nominal; 11" x 12 3/4" sheets.
   3. Thickness: 3/16 inch.
   4. Edges: Cushioned.
   5. Surface Finish: Matte glazed.
   6. Color(s): To be selected by Architect from manufacturer's standard range.
   7. Pattern: As indicated on the drawings.
   8. Products:
      a. Bedrosians Tile: Le Cafe .
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: finish as indicated on the drawings, style and dimensions as indicated on drawings, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.

b. Open edges of floor tile.
c. Wall corners, outside.
d. Transition between floor finishes of different heights.
e. Borders and other trim as indicated on drawings.

2. Locations: See drawings.
3. Manufacturers:
   a. Schluter-Systems: Products: as listed on the drawings, www.schluter.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: 1, 1, or [_____].

2.04 GROUTS

A. Manufacturers:
   1. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: All locations.
   2. Color(s): As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. 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 tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor and wall joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles square.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
   1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F143.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

C. Install additional thickenss of plywood underlayment (field verify thickness) so that ceramic tile floor is flush with existing hardwood floor to remain in adjacent areas.

3.05 INSTALLATION - WALL TILE

A. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface as recommended by grout and mortar manufacturer.

3.08 SCHEDULE

A. See finish floor plans and interior elevations for locations and patterns.

END OF SECTION

SECTION 09 9000

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Shop application of powder coat finishes.

D. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated. See drawings for specifics.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Exposed surfaces of steel lintels and ledge angles.
   4. Mechanical and Electrical:
      a. In finished areas, paint shop-primed items, mechanical wall grilles/diffusers and other items called out on the drawings.
      b. On the roof and outdoors, paint all equipment that is exposed to weather or to view, including that which is factory-finished, and as noted on the drawings (Electrical CT Cans and meters on the face of the building).
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

E. 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, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   7. Marble, granite, slate, and other natural and synthetic stones.
   8. Floors, unless specifically so indicated.
   9. Ceramic, porcelain and other tiles.
   10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Glass.
   12. Concrete masonry in utility, mechanical, and electrical spaces.
   13. Acoustical materials, unless specifically so indicated.
   14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Shop-primed items.

B. Section 05 5100 - Metal Stairs: Shop-primed items and Shop-powder coated items.

C. Section 06 2000 - Finish Carpentry: Wood items to receive finish and existing/salvaged wood for refinishing.

D. Section 08 1113 - Hollow Metal Doors and Frames: Shop-primed items.

E. Section 09 2116 - Gypsum Board Assemblies: Wall surfaces receiving paint.

F. Section 23 0553 - Identification for HVAC Piping and Equipment: Painted identification.

1.03 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 D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

E. AAMA 2605 - American Architectural Manufacturers Association: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coating on Architectural Extrusions and Panels.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

C. Verification Samples: Submit two paper "draw down" samples, 3 x 5 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. For Powder coat samples, submit two verification samples on actual material, 6" in length.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

C. For Powder Coating, applicator qualifications: Certified by AAMA.

1.06 WARRANTY

A. Powder Coating:
   1. Furnish manufacturer's 10 year warranty providing coverage that coatings:
      a. Will not chip, crack or peel (lose adhesion) but this does not include minute fracturing which may occur in proper fabrication.
      b. Will not chalk in excess of ASTM D4214 Number 8 rating, determined by procedure outlines in ASTM D4214.
      c. Will not change color more than five Delta-E Hunter units (square root of the sum of square Delta L, Delta a, and Delta b) as determined by ASTM D2244, Method 6.3. Fading or color changes may not be uniform if surfaces are not equally exposed to sun and elements.

2. Furnish applicator's 10 year warranty providing coverage against failure of PVDF-based coating over improper pretreatment where coating was not applied in accordance with ASTM D1730, Type B, Method 5 or ASTM B449, Section 5.

1.07 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.

1.08 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all field paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all shop paint and coating products used in any individual system from the same manufacturer; no exceptions.

C. Field Paints:
1. Base Manufacturer: Sherwin Williams.
2. Diamond Vogel Paints: www.diamondvogel.com.
3. Benjamin Moore & Co: www.benjaminmoore.com.

D. Stains:
1. Base Manufacturer: Sherwin Williams.

E. Primer Sealers: Same manufacturer as top coats.

F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIELD 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. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. 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.

D. Flammability: Comply with applicable code for surface burning characteristics.

E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

F. Paint Colors: As indicated on drawings or as selected from manufacturer's standard color range.

G. Stain Colors: Custom field mix. Different trim/wood species and existing salvaged wood may require separate/different custom field mix to match.
   1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
   2. Allow for number of paint colors as shown on finish floor plans.
   3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 FIELD PAINT SYSTEMS - EXTERIOR

A. Wood, Opaque, Alkyd, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Semi-gloss: Two coats of alkyd enamel; _____.

B. Concrete/Masonry, Opaque, Alkyd, 3 Coat:
   1. One coat of block filler.
   2. Semi-gloss: Two coats of alkyd enamel; ____.

C. Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Semi-gloss: Two coats of alkyd enamel.

D. Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   2. Semi-gloss: Two coats of alkyd enamel.

2.04 PAINT SYSTEMS - INTERIOR

A. Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Eggshell Finish: Two coats of alkyd enamel.

B. Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with alkyd primer.
   2. Eggshell Finish: Two coats of alkyd enamel.

C. Galvanized Metals, Alkyd, 3 Coat:
   1. One coat galvanize primer.
   2. Eggshell Finish: Two coats of alkyd enamel.

D. Gypsum Board/Plaster, Latex, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Eggshell Finish: Two coats of latex enamel.

2.05 PAINT SYSTEMS - POWDER COATING

A. Shop-applied finish.
   1. PVDF-Based Coating: AAMA 2605, fluoropolymer finish containing minimum 70 percent PVDF resins.
   2. Two coat system (or number of coats to meet warranty requirements).
   3. Color to be selected from manufacturer's full color range.

2.06 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

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared and wall texture has been reviewed and approved.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. 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. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 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 repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

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. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of

phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

L. Interior Wood Surfaces to Receive Semi-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. See specification Section 06 2000 Finish Carpentry for additional requirements (sanding, wood filler, etc.) for existing/salvaged wood to be refinished.

M. Exterior Wood to Receive Semi-Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

N. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer. See specification Section 06 2000 Finish Carpentry for additional requirements (sanding, wood filler, etc.) for existing/salvaged wood doors to be refinished.

O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete and consistent coverage.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.06 SCHEDULE - COLORS

A. See drawings for paint colors and locations.

END OF SECTION

DIVISION

10

SPECIALTIES

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior directional and informational signs.

B. Plaque.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Installation of signs on interior walls.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc; ____: www.bestsigns.com.
   2. Inpro; _____: www.inprocorp.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Plaques:
   1. Gemini Inc.; www.geminisignproducts.com.
   2. Impact Architectural Signs; www.impactsigns.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 _____, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room, Directional, Informational and Door Signs: Provide a sign at locations called out on the drawings.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. See drawings for signage layout, size, and text height.

C. Plaque: See drawings for location, layout, and sizes.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/8 inch.

2.05 PLAQUES

A. Metal Plaques:
   1. Metal: Bronze casting.
   2. See drawings for layout and more information.

2.06 ACCESSORIES

A. Plaques - Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Other Signs - Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. See drawings for locations of all signage.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 2113.19

PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 09 3000 - Tiling: Tile flooring.

C. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum (5) years experience in manufacture of solid plastic toilet compartments with products in satisfactory use under similar service conditions.

B. Installer Qualifications: Minimum (5) years experience in work of this Section.

1.05 WARRANTIES

A. Proivde manufacturer's 25 year warranty against breakage, corrosion, and delamination under normal conditions.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, 4 by 4 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Hiny Hinders by Scranton Products.
   2. Substitutions: Section 01 6000 - Product Requirements.

2.02 SOLID PLASTIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), floor-mounted headrail-braced.
   1. Color: As selected from manufacturer's full range of colors.
   2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instraments.
   3. Thickenss: 1 inch with 1/4 inch radius edges.

B. Doors:
   1. Width: 24 inch.
   2. Width for Handicapped Use: 36 inch.
   3. Height: 55 inch.

C. Panels:
   1. Height: 55 inch.

D. Pilasters:
   1. Width: As required to fit space; minimum 3 inch.

E. Urinal Screens: Wall mounted with continuous panel bracket, and vertical upright consisting of pilaster anchored to the floor.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 inch high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Hollow stainless steel, 1 x 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.

C. Pilaster Brackets: Satin stainless steel.

D. Wall Brackets: Continuous type, satin stainless steel.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

F. Hardware: Satin stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Door Latch: Slide type with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Evidence of cutting, drilling or patching is not acceptable.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Accessories for toilet rooms and utility rooms.

C. Diaper changing stations.

D. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking in walls for accessory supports.

B. Section 09 3000 - Tiling: Ceramic washroom accessories.

C. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

G. ASTM C1036 - Standard Specification for Flat Glass; 2011.

H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. ASI - American Specialties, Inc: www.americanspecialties.com.
   2. Bradley Corporation: www.bradleycorp.com.
   3. Substitutions: Section 01 6000 - Product Requirements.

B. Diaper Changing Stations:
   1. American Specialties, Inc; _____: www.americanspecialties.com.

2. Bradley Corporation; _____: www.bradleycorp.com.

C. All items of each type to be made by the same manufacturer.

2.02 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. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Adhesive: Two component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel where painted surfaces are noted.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Large Double roll, surface mounted bracket type, stainless steel.
   1. Product: See drawings for manufacturer and product info.

B. Combination Towel Dispenser/Waste Receptacle: Recessed ____, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
   1. Towel dispenser capacity: 400 C-fold.
   2. Waste receptacle capacity: 4 gallons.

C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.

D. Mirrors: Frameless, eased edges, 1/4 inch thick annealed float glass, ASTM C1036.

E. Grab Bars: Stainless steel, nonslip grasping surface finish.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Mounting Kits: Provide manufacturer standard for toilet partition and masonry walls substrates.
      d. Length and Configuration: As indicated on drawings.
      e. Products: See drawings for manufacturer and product info.

F. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Proudct: See drawings for manufacturer and product info.

G. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.

1. Style: Horizontal.
2. Mounting: Surface.
3. Product: See drawings for manufacturer and product info.

2.05 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: 3 spring-loaded rubber cam holders.
   2. Length: 36 inches.
   3. Product: As indicated on the drawings.
   4. Substitutions: Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 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.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 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: As required by accessibility regulations, unless otherwise indicated. See accessories legend on interior elevation drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 2116 - Gypsum Board Assemblies: Metal stud framing coordination of rough opening.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Larsen's Manufacturing Co.: www.larsensmfg.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Larsen's Manufacturing Co: www.larsensmfg.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL for the purpose specified and indicated on the drawings.

2.03 FIRE EXTINGUISHER CABINETS

A. See drawings for specific requirements of cabinet.

B. Cabinet Configuration: Semi-recessed type.

C. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

D. Weld, fill, and grind components smooth.

E. Finish of Cabinet Interior: red colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers on wall brackets.

D. Position cabinet signage at glass in cabinet door as shown on the drawings.

3.03 SCHEDULES

A. See drawings for locations.

END OF SECTION

SECTION 10 5617

WALL MOUNTED STANDARDS AND SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shelf standards, brackets, and accessories.

B. Shelves.

C. See drawings for locations and configurations.

1.02 RELATED REQUIREMENTS (THIS LIST MAY NOT BE ALL INCLUSIVE)

A. Section 06 1000 - Rough Carpentry: Wood blocking in walls for attachment of standards.

1.03 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and elevated above grade.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Shelf Standards and Brackets:
   1. Knape & Vogt Manufacturing Company : www.knapeandvogt.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Shelves:
   1. Formica Corporation: www.formica.com.
   2. Wilsonart International, Inc.: www.wilsonart.com.
   3. Nevamar.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Heavy Duty Shelf Standards: Double-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
   1. Acceptable Product: K&V 85.
   2. Load Capacity: Recommended by manufacturer for loading of 300 to 680 pounds per pair of standards.
   3. Material: Steel.
   4. Lengths: As indicated on drawings.
   5. Finish: Powder-coated, white; provide screws with matching heads.
   6. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
   7. Bracket Quantity: Provide one bracket for each 12 inches of standard length.

B. Melamine Faced Shelves: Particleboard or medium density fiberboard coved with melamine on both sides.

1. Edge Finish: melamine.
2. Substrate Thickness: 1 inch, nominal.

C. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount standards to solid backing capable of supporting intended loads.

C. Install brackets, shelving, and accessories.

3.04 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 10 5626
MOBILE STORAGE SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mechanically assisted mobile storage shelving systems.

B. Manual mobile storage shelving systems.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

C. American National Standards Institute (ANSI) Standards.

D. American Society for Testing and Materials (ASTM) Standards.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate location, type, and layout of mobile storage shelving system, including lengths, heights, and aisle layout, and relationship to adjacent construction.
   1. Indicate location and configuration of rails.
   2. Indicate method of installation and configuration for shelving mounted on carriages.
   3. Provide location and details of anchorage devices to be embedded in or fastened to the structure.

C. Selection Samples: For each finish product specified, provide color chips representing manufacturer's full range of available colors and finishes.

D. F. Maintenance Data: Provide manufacturer’s operation manual, maintenance and care instructions, and instructions for care and cleaning of the finish.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage an experienced manufacturer who has been continuously manufacturing this type of product without interruption for a minimum of 20 years and can supply a list of references upon request.

B. Manufacturing Qualifications: Engage an experienced manufacturer whose internal processes meet or exceed ISO 9001 requirements.

C. Installer Qualifications: Engage an experienced installer who is authorized by the manufacturer to install a high-density mobile system of this magnitude and has a minimum of 1 year experience doing so.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged components.

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

C. Store under cover and elevated above grade.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a written warranty, executed by contractor, installer, and manufacturer, agreeing to repair or replace equipment which fails in materials or workmanship within the established

warranty period. This warranty shall be in addition to, and not a limitation of, other rights the owner may have under general conditions provisions of the contract documents.

C. In addition, shall warrant the high-density mobile storage system against defects in material and workmanship for a minimum of 10 years from date of final acceptance by owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mobile Storage Shelving Systems:
   1. Aurora Storage Products.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MOBILE STORAGE SHELVING SYSTEMS - GENERAL

A. System Description: High-density movable shelving system consisting of shelving units mounted on rail-guided wheeled carriages.
   1. Carriage Operation: Low Profile Mechanically assisted.
      a. Tri-spoke handle driven mechanical assisted carriages and related equipment containing existing storage housings provided by the owner for installation.
   2. Carriage Capacity: Equivalent to basis of design.
   3. Rail Mounting: Recessed in concrete slab with finished floor flush with top of rails.

B. Accessibility Requirements: Comply with ADA Standards.

C. Components:
   1. Wheels: Cold rolled steel; dual flanged.
   2. Rails: Cold rolled steel; type and size to carry loads imposed by system.
   3. Anti-Tip Device: Provide manufacturer's standard rail device to prevent tipping of system.
   4. Shelving Units: Furnished by Owner and installed by contractor as indicated on the drawings.
   5. Floor Covering: As specified in Section Section 03 3000: concrete.
   6. Grout: Non-shrink hydraulic type cement.

D. Design Requirements:
   1. Consult drawing for plan view and elevation details.
   2. For ceiling height or sprinkler code requirements, rail with required grout for leveling, carriage structure, and storage housing heights must be considered for an overall system height.
   3. Carriages shall be designed to accommodate existing or new storage housings as specified in accompanying documentation.

E. Accessories:
   1. Anchors and Leveling Screws: Types and sizes recommended by manufacturer for specified rail mounting and floor system.
   2. Bumpers: Manufacturer's standard rubber stops.

2.03 MECHANICALLY ASSISTED MOBILE STORAGE SHELVING SYSTEMS

A. Description: High-density mobile storage system consisting of strage housings mounted on wheeled carriage assemblies riding on multiple steel rails. Purpose is to allow multiple ranges of storage housings to be accessed by means of one roving aisle, thus greatly reducing floor space requriements from that of conventional rows of storage housings. For clarification, the term "storage housing" shall refer to the shelving, rack or cabinets which are a component of the high-density mobile system herin specified.

B. Carriage: The carriage shall be formed of a welded structural steel frame with machined steel wheels mating and/or aligning to corresponding steel rails. All bearings shall be permanently lubricated and shielded.

C. Drive Controls: Triple arm operating control with ergonomic user-friendly knobs shall be provided on the drive ends. A minimum of one operation knob per carriage shall be within ADA reach guidelines at all times.

1. Front drive control consisting of chain, sprocket, and upper drive bearing assembly shall be completely self-contained and enclosed within a steel housing independent of the face panel and shall be an integral part of the carriage structure. Carriage end panel drive assemblies which merely attach to the face panel and are not supported by a dedicated structure shall be unacceptable.
2. Carriage drive mechanism shall be a direct line shaft thru-wheel drive to provide an efficient, smooth, non-binding, and non-slipping movement. Drive system shall be designed to provide a movement of up to 4,000 lbs. of load with only 1 lb. of user effort at the drive control handle.
3. All bearings in drive system shall be permanently lubricated and shielded.

D. Safety Items:
1. A user activated safety locking mechanism shall be provided at every carriage control to prevent unintentional carriage movement.
2. An interconnected dual aisle safety locking mechanism for dual end control carriages shall be provided to enable securing an open aisle at one end of the carriage/aisle and releasing it from the opposite end of the carriage/aisle.

E. Finishes:
1. Metal Components and Assemblies:
a. All components shall be finished with an electrostatically applied Gloss-Tek™ powder coat. Finish shall consist of a non-glare raised surface that provides scuff and scratch resistance. Finish shall be a non-VOC emitting hybrid powder coat which meets or exceeds ASTM test criteria for adhesion, flexibility, hardness, and humidity resistance. A minimum of 29 standard manufacturer's colors shall be offered at no additional charge and a minimum of 3 standard metallic colors shall be provided at an upcharge not to exceed 15%. Any special color match shall be made available per the standard manufacturer's published policy.
2. Laminate Panels:
a. a. High Pressure Laminate Finish: To be selected from manufacturer's standard high pressure WilsonArt™ available colors and patterns.
b. (optional) High Pressure Laminate Finish: Provide another laminate manufacturer's color and pattern selection as selected by owner or architect.
c. Low Pressure Laminate Finish: To be selected from manufacturer's standard Thermal Fused low pressure laminate finishes.

2.04 BASIC MATERIALS

A. General: Provide materials and quality of workmanship, which meet or exceed established industry standards for products specified. Material selection and composition shall be manufacturer's option unless indicated otherwise. Fabricate units from ASTM Class 1, cold-rolled commercial grade sheet or coil steel with all bends and radiuses consistent and true.

B. Grout: Shall be ready-mixed high strength; controlled expansive grout with superior dynamic load stability, which when mixed with water shall harden rapidly to produce a permanent foundation for the mobile storage system. Grout shall be non-corrosive, non-metallic and non-shrink. The grout after curing shall have a minimum strength of 8000 pounds (3629 kg) per square inch.

C. MANUFACTURED COMPONENTS
1. A. Rail:
a. Rail shall be ASTM/AISI Type 1045 steel of manufacturer's selection designed and manufactured to carry a load of 1000 pounds per lineal foot (1488 kg/m) of carriage length.
1) Rail shall be designed to be anchored to structurally sound base floor capable of supporting fully loaded system and exhibiting a maximum deflection not to exceed L/700.
2) Rail shall be positioned, leveled and grouted in accordance with the manufacturer's instructions, providing a minimum of 7/16 inch (11 mm) of grout

under the rail from the high spot on the floor. Void under leveled rail shall be completely filled with a non-shrink grout.

3) Shimming of rail is not acceptable either as a means of support or for leveling. Rail shall be drilled and tapped to accommodate leveling screws adjacent to all anchor holes. Each rail shall have a minimum width of 2-3/8 inch (60 mm) and all rails must extend completely under all stationary ranges.

4) Rail shall be level not to exceed 1/16 inch (1.6 mm) maximum variation from true level within module and 1/16 inch (1.6 mm) maximum variation between adjacent rails perpendicular to rail direction. Each section of rail shall be a minimum of 12 inches (305 mm) and a maximum of 120 inches (3048 mm) with shorter length used only to terminate each individual rail assembly.

5) Each end of the rail shall be connected by means of twin stainless steel dowels pinned between the rail splice. The splice shall be designed for the most severe operating conditions. Connection joints shall demonstrate vertical and horizontal continuity and provide a transfer of load to and from the adjoining rail sections. Butt splice joints and tongue and groove rail splice joints which only prevent movement in one direction are unacceptable.

2. Carriages:
   a. Carriages are to be welded steel construction. Riveted or bolted carriages shall be unacceptable. Galvanized components are unacceptable. Components of unlike finish or material are unacceptable.
      1) Overall height shall be no greater than 4-1/2 inches (114 mm) from top surface of rail to base for storage housing on top of carriage.
      2) Carriage shall be designed for a capacity of 750 pounds per linear foot (1116 kg/m).
      3) Carriage construction shall provide for shelving to be securely anchored with vibration-proof fasteners.
      4) Carriages designed to recess the shelving or storage housing, thus causing the carriage to protrude beyond the plane of the face of the shelving or storage housing shall be unacceptable.
      5) Carriages shall be powder coat finished inside and out. Galvanized components are unacceptable.
      6) Fixed carriages shall be of the same construction and height as the mobile carriages and securely anchored to the continuous rail located beneath the fixed carriages.
      7) Splices shall be designed to maintain proper unit alignment with no visible fasteners on the outside of the carriage. Fasteners connecting any carriage splice joint shall be vibration-proof in design.
      8) Carriages shall be straight and square. There shall be no movement in any splice or welded joint when loaded to recommendation and normal operation is applied.
3. Wheels:
   a. All wheels whether load or driven shall be a minimum of 3-5/8 inches (92 mm) in diameter, constructed of cast ductile iron, and precision machined for smooth operation and to ensure compatibility to the corresponding rail.
      1) Bearings shall be permanently lubricated and shielded.
      2) Dynamic load rating on wheel bearings shall be a minimum of 5775 pounds (2620 kg) per wheel.
4. Guidance:
   a. 1. Guide Design:
      1) All rails and wheels shall guide carriage to ensure precise carriage tracking alignment.
         (a) All rails shall have a convex top surface to provide friction-free self-centering alignment with the carriage wheels.

(b) All carriage wheels shall have a concave load surface which aligns with the rail to provide precise carriage tracking.
(c) Roller guide and wheel flange methods of guidance which have play between the guide points and the rail sides shall be unacceptable.

2) 2. Drive Design:
(a) a. Carriage drive shall consist of a continuous thru-wheel shaft assembly driving all rails.
(b) b. Drive shaft shall be a minimum of 3/4 inch (19 mm) diameter solid steel and a non-load bearing member of the drive mechanism for ease of movement.
(c) c. Couplers shall be securely keyed into place to prevent looseness in the drive mechanisms.
(d) Systems that do not drive all rails shall be unacceptable.

5. Operation:
a. Gearing requirements unless specified will be at the discretion of the manufacturer based on anticipated weight load and carriage size. Reduction drive units must be available at the following ratios resulting in the noted carriage travel per revolution of the operator control handle:
1) 1:2000 ratio / 8-3/4 inches (222 mm) travel per revolution of operation handle
(a) 1:3000 ratio / 6-5/8 inches (168 mm) travel per revolution of operation handle
(b) 1:5000 ratio / 5-1/8 inches (130 mm) travel per revolution of operation handle
(c) 1:6000 ratio / 3-7/8 inches (98 mm) travel per revolution of operation handle
(d) 1:8000 ratio / 3 inches (76 mm) travel per revolution of operation handle
(e) 1:11000 ratio / 2-3/8 inches (60 mm) travel per revolution of operation handle
2) Operator handles shall be provided in an ergonomic three-spoke design with rotating knobs.
3) All operator handles shall be provided with a minimum 1.75” (44MM) diameter ergonomic push-pull knob (Aisle Safety Lock) located at the center of the operator handle to secure adjacent carriages in place while an aisle is being occupied. Smaller knobs shall be unacceptable.
4) Operator handles shall be available at each end of each possible aisle.
5) Operator handles and aisle access both into and around the system shall conform to all applicable codes including but not limited to the Americans with Disabilities Act.

6. End/Face Panels:
a. End panels or chain box covers shall be provided to cover the drive chain mechanism and enhance the aesthetics of the system.
1) End panels must extend the full width of the carriage and extend from the bottom edge of the carriage to the top of the storage housing on the carriage.
2) End panels:
(a) Steel: Panels less than 48 inches (1219 mm) in width shall be fabricated from 16 gauge powder coated steel. Panels 48 inches (1219 mm) wide and greater may be fabricated from a lesser gauge sheet steel if additional reinforcing hat channel are provided. Finish and color shall be selected from manufacturer’s full offering.

7. Environmental Requirements: All carriages, steel shelving, and steel end panels shall contain a minimum of 40% recycled steel content, comprised of a mixture of post and pre-consumer and industrial. Finishes on carriages, steel shelving, and steel end panels shall be a Gloss-Tek™ powder coat finish with low VOC (volatile organic compounds) and application must incorporate a powder recycle process.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on the drawings.

B. Verify that substrate is in proper condition to install rails and flooring system per manufacturer's requirements.

C. Verify that building floor structure is adequate to support high-density mobile system within limits of established deflection criteria based on mobile system type and manufacturer’s published criteria.

D. With installer present, examine floor area within area of mobile system to verify that it is in condition per manufacturer’s requirements for rail installation.

E. With installer present, examine mobile carriages for proper sizing, proper placements of support members for the shelving, and to ensure that mounting surface is square and level

F. For all installations it shall be the installer’s responsibility to know and to execute all phases of the installation in compliance with local building codes.

3.02 FABRICATION

A. General: Coordinate all parties to ensure timely execution of this project and to related work. Ensure that all necessary information relating to this portion of the project has been transmitted to the parties involved.

3.03 INSTALLATION

A. General: Install system components and accessories in accordance with manufacturer's printed instructions.

B. Position system components level and plumb within manufacturer's specified tolerances.

C. For recessed rail installation, grout rails the full length of the system.

D. Maintain a minimum of 1/4 inch of grout between the high points of concrete subfloor and bottom of rails.

E. Extend rails under stationary shelving units.

F. Position carriages ensuring wheels align properly on rails. Fasten multiple carriages together forming a single movable base.

G. Install shelving with shelf surfaces level and vertical supports plumb; fasten to carriage supports with vibration-proof fasteners.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Verify all fixed and movable carriages are installed and operating square and level. Correct if necessary.

C. Verify all end or face panels, shelving components and accessories are aligned properly. Correct if necessary.

D. Replace components that are scratched, dented, or damaged in any manner with new items from the manufacturer. Surface scratches may be touched up but repair must be complete and undistinguishable.

3.05 ADJUSTING

A. Adjust mobile storage shelving components and accessories to provide for smooth operation of system.

3.06 CLEANING

A. Clean shelving and surrounding area after installation.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.08 PROTECTION

A. Protect installed system from subsequent construction operations.

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

END OF SECTION

SECTION 10 7500

FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.

B. Electrical: lighting of flag/flagpole.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Operation Data: Provide operating data for the controller.

E. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules and _____.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole; ____: www.americanflagpole.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Straight shaft.
   3. Mounting: Ground mounted type.
   4. Nominal Height: thirty five ft; measured from nominal ground elevation.
   5. Halyard: Interior type.

B. Performance Requirements:
   1. Meet wind resistance per the Uniform Building Code, 2015 edition.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Stainless steel, 6 inch diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Flag: _____ design, six ft by ten ft size, nylon fabric, brass grommets, hemmed edges.

D. Cleats: 9 inch size, aluminum with galvanized steel fastenings, two per halyard.

E. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

F. Halyard: 5/16 inch diameter polypropylene, braided, white.

2.05 OPERATORS

A. Hand Crank: Removable _____ type.

2.06 MOUNTING COMPONENTS

A. Pole Base Attachment: Flush; aluminum base with base cover.

2.07 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Aluminum: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as instructed by the manufacturer.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Fill foundation tube sleeve per the manufacturer's recommendations for height of pole and wind speed.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

DIVISION

12

FURNISHINGS

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Motorized roller shades.

B. Electric motor operators.

C. Motor controls.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 09 9000 - Painting and Coating: finish surfaces for attachment of roller shades.

1.03 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

B. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken.
   2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details and mounting dimension requirements for each product and condition.

D. Shop Drawings - Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

E. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience.
   1. Factory training and demonstrated experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's lifetime limited warranty from Date of Substantial Completion, covering the following:

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Motorized Roller Shades, Motors and Motor Controls:
   1. Hunter Douglas Architectural
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WINDOW SHADE APPLICATIONS

A. Interior Roller Shades: Blackout shades.
   1. Type: Roll down, closed position is at window sill.
   2. Fabric Performance Requirements:
      a. Openness Factor: 1%.
      b. Fabric Content: 36% Fiberglass, 64% Vinyl.
   3. Color: As selected by Architect from manufacturer’s full range of colors.
   4. Mounting: Inside (between jambs).

2.03 ROLLER SHADES

A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
   1. Size: field verify per window size.

B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Flammability: Pass NFPA 701 large and small tests.

C. Roller Tubes: As required for type of operation.

D. Hembars: Designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.

E. Motor Operation: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed to UL 325.
   1. Audible Noise: Maximum 39 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.
   2. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view.
   3. Motor Type: Intelligent AC motor 115 VAC, 50-60 Hz, thermally protected, lifetime lubricated, equippped with an internal thermal overload protector. Maximum current draw not to exceed 0.9 amps when operating up to an overall width of 156", or a maximum current of 1.8 amps when operating 156" + overall width.
      a. Motor must include an embedded motor control system without requiring any exernal motor logic control system outside of the motor assembly unit itself.
      b. Design of motor control system is based on the Somfy RTS control system manufactured by Hunder Douglas Contract Window Coverings.
         1) Ability to provide group control of all roller shades on east side of building and separate control of roller shades on west side of building.
      c. Motor control system must be integrated into the motor unit itself. External motor control systems that require "home run" 110v line voltage will not be accepted.
      d. Control option: Chronis Wall Switch Timer.

2.04 ACCESSORIES

A. Fascias: Size as required to conceal shade mounting.
   1. Style: As selected by Architect from shade manufacturer's full selection.
   2. Material and Color: To match shade.

B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.05 FABRICATION

A. Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

B. Dimensional Tolerances: As recommended in writing by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation Tolerances:
   1. Maximum Offset From Level: 1/16 inch.

C. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

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

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metallic laminates for custom elevator cab finish.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: plywood backing at elevator cab.

B. Section 14 2010 - Passenger Elevators.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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

C. Shop Drawings: Complete details of materials and installation.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD 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.

PART 2 PRODUCTS

2.01 CUSTOM ELEVATOR CAB FINISH

A. Quality Standard: Custom Grade, in accordance with MED-B-8421, unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure metallic laminate series sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers:
         1) Chemetal.
         2) Substitutions: See Section 01 6000 - Product Requirements.
      b. Surface Burnign Characteristics: Flame spread index of 5, maximum; smoke developed index of 25, maximum; when tested in accordance with ASTM E84.
      c. Finish: metallic.
      d. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
   2. Back and End Splashes: Same material, same construction.

2.02 FABRICATION

A. Fabricate in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.

2. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach laminate using screws with minimum penetration into substrate board of 1/2 inch.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/32 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 12 4813

ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tapered Aluminum entrance floor mats.

1.02 QUALITY ASSURANCE

A. Flammability in Accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/mm.

B. Slip Resistance in Accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60.

C. Standard rolling load performance is 350 lb./wheel with larger loading requirements as specified (load applied to a solid 5" x 2" wide polyurethan wheel, 1000 passes without damage).

D. Manufacturer to be ISO 9001 & 14001 certified.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions.

C. Shop Drawings: Indicate dimensions.

D. Samples: Submit two samples, 6 by 6 inch in size illustrating pattern, color, finish, edging and carpet inlay.

E. Maintenance Data: Include cleaning instructions, stain removal procedures and _____.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Floor Mats:
   1. Construction Specialties.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ENTRANCE FLOOR GRILLES AND GRATINGS

A. Mounting: Loose layed on top of finish flooring.

B. Structural Capacity: Capable of supporting a rolling load of 500 pounds without permanent deformation or noticeable deflection.

C. Vibration Resistant Fabrication: All members welded, riveted, or bolted; no snap or friction connections.

2.03 MATS

A. Aluminum - ASTM B 221, alloys 6063-T5, 6063-T6 for extrusions.

B. Flexible EPDM extrusions.

C. Mat Frame: Tapered Angle Fram.

D. Tread Insert: Exterior Carpet.
   1. Solution dyed polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament,.
   2. Colors: as selected from manufacturers standards.

2.04 FABRICATION

A. Fabricate mats in single unit sizes; fabricate multiple mats where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor opening for mats are ready to receive work.

END OF SECTION

DIVISION

14

CONVEYING EQUIPMENT

SECTION 14 2010

PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete elevator systems.

B. Elevator maintenance.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Includes elevator machine foundation and pit.

B. Section 05 1200 - Structural Steel Framing: Includes hoistway framing and overhead hoist beams.

C. Section 05 5000 - Metal Fabrications: Includes pit ladder, sill supports, and overhead hoist beams.

D. Section 06 1000 - Rough Carpentry: Wall framing of elevator shaft.

E. Section 07 1300 Sheet Waterproofing: Waterproofing of elevator pit walls and floor.

F. Section 09 2116 - Gypsum Board Assemblies: Gypsum shaft walls.

G. Section 31 2316 - Excavation: Excavation for cylinder casing.

H. Section 31 2323 - Fill: Backfilling at cylinder casing.

1.03 SYSTEM DESCRIPTION

A. Equipment Description: Gen2® gearless machine-room less elevator where all components fit inside the hoistway.

B. Equipment Control: Elevonic® Control System.

C. Drive: Regenerative

D. Quantity of Elevators: One.

E. Elevator Stop Designations:
   1. Sub-Basement
   2. Basement
   3. First (Museum)
   4. Second (Conference)

F. Stops: Four.

G. Openings: Front

H. Travel (maximum): Approximately 35'-8"

I. Rated Capacity: 5000 lb.

J. Rated Speed: 150 fpm

K. Platform Size: (nominal) 6’-0 ½” W x 9’-1 ¼” D

L. Clear Inside Dimensions: (nominal) 5’-11 5/16” W x 8’-4 3/16” D

M. Cab Height: 7'-9"

N. Clear Cab Height: 7’-9” with 5/16” Floor Recess and 4 LED Ceiling

O. Entrance Type and Width: Two Speed Doors at - 48” (1219 mm)

P. Entrance Height: 7’-0” (2134 mm)

Q. Main Power Supply: three-phase, with a separate equipment grounding conductor.

R. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.

S. Machine Location: Inside the hoistway at the top of the hoistway or in elevator equipment room provided.

T. Signal Fixtures: Manufacturer’s standard with metal button targets (excluding CA).

U. Controller Location: Machine-Roomless controller(s) must be in the front wall on the same side as the counterweight, located at the top landing. Optional Machine-Room/Space. Optional remote controller.

V. Performance:
   1. Car Speed: ± 3 % of contract speed under any loading condition or direction of travel.
   2. Car Capacity: Safely lower, stop and hold up to 120% of rated load (code required).
   3. Ride Quality:
      a. Vertical Vibration (maximum): 20 milli-g
      b. Horizontal Vibration (maximum): 12 milli-g
      c. Vertical Jerk (maximum): 4.59 ± 1.0 ft./ sec3 (1.4 ± 0.3 m/ sec3)
      d. Acceleration/Deceleration (maximum): 2.62 ft./ sec2 (0.8 m/ sec2)
      e. In Car Noise: 55 - 60 dB(A)
      f. Stopping Accuracy: ± 0.375 in. (± 10 mm) max, ± 0.25 in. (± 6 mm) Typical
      g. Re-leveling Distance: ± 0.5 in. (± 12 mm)

W. Operation:
   1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

X. Operation Features - Standard
   1. Full Collective Operation
   2. Anti-nuisance.
   3. Fan and Light Protection.
   4. Load Weighing Bypass.
   5. Independent Service.
   6. Firefighters' Service Phase I and Phase II
   7. Top of Car Inspection.

Y. Operation Features
   1. Zoned Access at Bottom Landing.
   2. Zoned Access at Upper Landing.

Z. Door Control Features:
   1. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
   2. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
   3. Door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening.
   4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

1.04 REFERENCE STANDARDS

A. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.

B. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2014.

C. ADAAG, American Disabilities Act Accessibility Guidelines.

D. ANSI A117.1, Building and Facilities, Providing Accessibility and Usability for Physically Handicapped People.

E. ANSI/UL 10B, Standard for Fire Test of Door Assemblies.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

H. UBC - Uniform Building Code, 2015.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Construction Use of Elevator: Not permitted.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on the following items:
   1. Signal and operating fixtures, operating panels, indicators.
   2. Cab design, dimensions, layout, and components.
   3. Cab and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

C. Shop Drawings: Indicate the following information:
   1. Locations of Machine Room Equipment: Driving machines, controllers, governors and other components.
   2. Hoistway Components: Car, counterweight, sheaves, machine and sheave beams, guide rails, buffers, ropes, and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Clearances and over-travel of car and counterweight.
   5. Locations in hoistway and machine room of traveling cables and connections for car light.
   6. Location and sizes of access doors, doors, and frames.
   7. Expected heat dissipation of elevator equipment in machine room.
   8. Electrical characteristics and connection requirements.

D. Maintenance Data: Include:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Technical information for servicing operating equipment.
   3. Legible schematic of hydraulic piping and wiring diagrams of installed electrical equipment and changes made in the Work. List symbols corresponding to identity or markings on machine room and hoistway apparatus.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with applicable code and as supplemented in this section.

B. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.

C. Fabricate and install door and frame assemblies in accordance with NFPA 80 for a 2-hour fire rating.

D. Perform electrical work in accordance with NFPA 70.

E. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum fifteen years documented experience.

F. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.

G. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

H. Products Requiring Fire Resistance Rating: Listed and classified by UL.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. The elevator contractor’s acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall not extend longer than one (1) year from the date of completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator

contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Design based upon Otis Elevator's Gen2™ machine room-less elevator system.

B. Other Acceptable Manufacturers:
   1. ThyssenKrupp Elevator; ____: www.thyssenkruppelevator.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. All components to be manufactured by same entity .

2.02 DESIGN AND SPECIFICATIONS

A. Provide machine-roomless Gen2™ traction passenger elevators from Otis Elevator Company. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
   1. Controller located entirely inside the hoistway. An optional machine-room or control closet space may be selected.
   2. An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.
   3. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
   4. Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
   5. LED lighting standard in ceiling lights and elevator fixtures.
   6. Sleep mode operation for LED ceiling lights and car fan.

B. Approved Installer: Otis Elevator Company

2.03 EQUIPMENT: CONTROLLER COMPONENTS

A. Controller: A microcomputer based control system shall be provided to perform all of the functions of safe elevator operation. The system shall also perform car and group operational control.
   1. All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
   2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
   3. Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
   4. Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 - immunity"
   5. Controller shall be located inside the wall next to the top landing entrance frame. Emergency access shall be provided through an access panel in the entrance frame secured by a key lock.

B. Drive: A Variable Voltage Variable Frequency AC drive system shall be provided. The drive shall be set up for regeneration of AC power back to the building grid.

2.04 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: The governor shall be a tension type car-mounted governor.

C. Buffers, Car, and Counterweight: Polyurethane type buffers shall be used for speeds of 150 and 200 feet per minute. Oil buffers shall be used for a speed of 350 feet per minute.

D. Hoistway Operating Devices:
   1. Emergency stop switch in the pit.

2. Terminal stopping switches.

E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.

H. Governor Rope: Governor rope shall be steel and shall consist of at least eight strands wound about a sisal core center.

I. Fascia: Galvanized sheet steel shall be provided at the front of the hoistway.

J. Hoistway Entrances:
   1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
   2. Sills shall be extruded:
      a. Bronze Finish
   3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
   4. Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour
   5. Entrance Finish:
      a. Paint
      b. Color to be selected from the manufacturer's color chart.
   6. Entrance Marking Plates: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
   7. Sight Guards: Sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel doors.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame and Safety: A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp type.

B. Cab: Custom field finish as indicated on the drawings.

C. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

D. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.

E. Handrail: Custom field finish and installed as indicated on the drawings.

F. Threshold: Bronze Finish.

G. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

H. Guides: The car shall have 3” diameter roller guides at top and bottom and the counterweight shall have slide type guides at the top and the bottom. Optional counterweight guides available.

I. Platform: The car platform shall be constructed of metal. Load weighing device shall be mounted on the belts at the top of the hoistway.

J. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish.
   1. A car operating panel shall be furnished. It shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings with:
      a. Vandal-Resistant, Flush satin stainless steel button with blue LED illuminating center jewel
   2. The car operating panel shall be equipped with the following features:
      a. Raised markings and Braille to the left hand side of each push-button.
      b. Car Position Indicator at the top of and integral to the car operating panel.
      c. Door open and door close buttons.
      d. Inspection key-switch.
      e. Elevator Data Plate marked with elevator capacity and car number.
      f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
      g. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
      h. In car stop switch (toggle or key unless local code prohibits use)
      i. Firefighter's hat
      j. Firefighter's Phase II Key-switch
      k. Call Cancel Button

B. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.

C. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation.
   1. Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance frame face or the wall. Buttons shall be in vertically mounted fixture. Fixture shall be satin stainless steel finish.
   2. Button Options:
      a. Vandal-Resistant, Flush satin stainless steel button with blue LED illuminating center jewel

D. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

E. Access key-switch at top floor in entrance jamb.

F. Access key-switch at lowest floor in entrance jamb.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

C. Verify that hoistway, pit, and machine room are ready for work of this section.

D. Verify hoistway shaft and openings are of correct size and within tolerance.

E. Verify location and size of machine foundation and position of machine foundation bolts.

F. Verify that electrical power is available and of the correct characteristics.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.

B. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage, and redeliver to the job site shall not be at the expense of the elevator contractor.

3.03 INSTALLATION

A. Install system components. Connect equipment to building utilities.

B. Provide conduit, boxes, wiring, and accessories.

C. Accommodate equipment in space indicated.

D. Bolt or weld brackets directly to structural steel hoistway framing.

E. Coordinate installation of hoistway wall construction.

F. Install hoistway door sills, frames, and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.

G. Adjust equipment for smooth and quiet operation.

3.04 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.

B. Adjust automatic floor leveling feature at each floor to achieve 1/4 inch from flush.

3.05 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components ready for inspection.

3.06 PROTECTION

A. Do not permit construction traffic within cab after cleaning.

B. Protect installed products until project completion.

C. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

3.07 MAINTENANCE AND SERVICE

A. MAINTENANCE SERVICE CONSISTING OF REGULAR EXAMINATIONS AND ADJUSTMENTS OF THE ELEVATOR EQUIPMENT SHALL BE PROVIDED BY THE ELEVATOR CONTRACTOR FOR A PERIOD OF TWELVE MONTHS (12) AFTER THE ELEVATOR HAS BEEN TURNED OVER FOR THE CUSTOMER'S USE. THIS SERVICE SHALL NOT BE SUBCONTRACTED BUT SHALL BE PERFORMED BY THE ELEVATOR CONTRACTOR. ALL WORK SHALL BE PERFORMED BY COMPETENT EMPLOYEES DURING REGULAR WORKING HOURS OF REGULAR WORKING DAYS. THIS SERVICE SHALL NOT COVER ADJUSTMENTS, REPAIRS OR REPLACEMENT OF PARTS DUE TO NEGLIGENCE, MISUSE, ABUSE OR ACCIDENTS CAUSED BY PERSONS OTHER THAN THE ELEVATOR CONTRACTOR. ONLY GENUINE PARTS AND SUPPLIES AS USED IN THE MANUFACTURE AND INSTALLATION OF THE ORIGINAL EQUIPMENT SHALL BE PROVIDED.

B. The periodic lubrication of elevator components shall not be required, including: Sheaves, Rails, Belts, Ropes, Car and CWT guides, etc.

C. The elevator control system must:
   1. Provide in the controller the necessary devices to run the elevator on inspection operation.
   2. Provide on top of the car the necessary devices to run the elevator in inspection operation.
   3. Provide in the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.
   4. Provide in the event of a power outage, means from the controller to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing.
   5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
   6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
   7. (Optional) Provide the means from the controller to reset elevator earthquake operation.

D. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
   1. Remotely diagnose elevator issues with a remote team of experts
   2. Remotely return an elevator to service
   3. Provide real-time status updates via email
   4. Remotely make changes to selected elevator functions including:
      a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode, activate independent service.
      b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
      c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

END OF SECTION

DIVISION

20

GENERAL MECHANICAL REQUIREMENTS

SECTION 20 0050 - COMMON PLUMBING AND HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work to be performed under the Plumbing and HVAC sections of the specification shall include all supervision, labor, equipment, and materials required and incidental to providing and installing complete and adjusted engineered systems, as shown on the drawings and described herein.

B. All plumbing and hvac specification requirements shall be considered complementary to other specification sections for the project. Where conditions of this section conflict with architectural bidding instructions and/or other general requirements, the architectural conditions shall take precedence.

C. All plumbing and hvac contractors shall plan their work in advance and coordinate all installation requirements with other trades. Contractors shall be held to have checked all construction documents for possible interference caused by work of other trades, conditions of the premises, and obstructions. Where conflicts occur, the contractor shall request clarification through the prime or general contractor.

1.02 INTENT AND RESPONSIBILITY

A. Execution of the work shall be governed by the construction documents: architectural, structural, plumbing, hvac, and electrical drawings, where applicable, as well as drawings of associated trades. Locations of piping, equipment, ducts, etc. on the drawings are diagrammatic; indicated positions shall be followed as closely as possible, however, exact locations shall be subject to building construction conditions and interferences with other work.

B. Before fabrication, piping and ductwork shall be checked with the building construction for dimensions, locations, clearances, etc. Ductwork and piping shall be made up with the necessary variations to conform to the details of the construction of the building. Ductwork and piping that is made up before hand and found that it will not fit into allocated spaces shall be re-constructed at the expense of the contractor.

1.03 CODES, RULES, PERMITS, AND FEES

A. All materials furnished and all work installed shall comply with all state and locally adopted nationally recognized and consolidated building codes and standards, with requirements of local utility companies, and with the requirements of all governmental authorities having jurisdiction.

B. The contractor shall give all necessary notices, obtain all permits and pay all sales taxes, fees, and other costs, including utility connections or extensions, in connection with his work; file all necessary plans, prepare documents and obtain all necessary approvals of governmental departments having jurisdiction; obtain all required certificates of inspection and deliver same to the engineer before request for acceptance and final payment.

C. The contractor shall include in the work, without extra cost to the owner, any labor, materials, services, apparatus, drawings, etc. in order to comply with all applicable laws, ordinances, rules and regulations, whether indicated or not on the drawings. Where materials or installations that are specified or detailed in a way that conflicts with or is perceived to conflict with governing requirements, the contractor shall request clarification from the engineer prior to bidding.

1.04 CONSTRUCTION DRAWINGS

A. The drawings and the specifications are intended to be complimentary. Where conflicts exist between the drawings and specifications, and the contractor fails to notify the engineer prior to issuance of the final addendum, the contractor will be held to have considered the most expensive option.

B. Drawings are diagrammatic and generally indicative of the work. The contractor shall follow the drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed.

C. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the engineer shall be notified before proceeding with installation to prevent conflict with work of other trades and for proper execution of the work.

1.05 SURVEYS AND MEASUREMENTS

A. The contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements on site and check the correctness of same as related to the work.

B. Should the contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings, he shall request clarification through the general contractor, and shall not proceed with the work until he has received instructions from the engineer.

1.06 SUBSTITUTIONS

A. See Division 01 General Requirements, for additional substitution procedures.

B. A specification in which a manufacturer's product is named and accompanied by the words "basis of design", including make or model number or other designation, shall establish significant qualities and other characteristics for purposes of evaluating comparable products of additional manufacturers.

C. Where specifications name a basis of design product, or refer to a basis of design product indicated on the drawings, and other products or manufacturers are not listed, provide the specified or indicated product or an approved comparable product. Equipment scheduled on the drawings shall be considered the "basis of design".

D. Wherever the word "equal", or words to the same effect are used in connection with a specified product, it is to be understood that such words mean any product substitution claimed to be an equal shall be reviewed and accepted in writing by the engineer. Products and materials not specifically identified as accepting “equals”, and which have not been submitted for prior review, will be summarily rejected.

E. Pre-bid requests for substitution must be received by the engineer one calendar week prior to the bid date (or as otherwise specified in the instructions to bidders), so that they may be processed and included by addendum for the benefit of all bidders. Requests received after the deadline will not be considered. A substitution request from must accompany each individual application with undersigned certification as described below.

F. Requests shall indicate the paragraphs and/or drawing details from which the proposed construction and/or function varies from the items specified, and shall provide complete data showing and explaining all such changes or variations the bidder proposes to make from the drawings and specifications.

G. It is further understood that no material or work shall be presented to the engineer as equal to that specified without the full understanding on the part of the manufacturer, the supplier, and the contractor, that the engineer is to use his own judgment in determining equivalency, and the decision is final.

1.07 SUBSTITUTION REQUESTS

A. Document each request with complete point-by-point comparative data substantiating compliance of the proposed substitution with the contract documents. Submit shop drawings, product data, etc attesting to the proposed product equivalence. Burden of proof is on the proposer.

B. A request for substitution constitutes a representation that the submitter certifies the following:
   1. Proposed product has been fully investigated and determined to be equal or superior in all respects to specified product.
   2. Proposed product is consistent with the design and/or design intent and will not require revisions to the contract documents.
   3. Proposed product is compatible with other portions of the work, and will produce the intended results.

4. Proposed product will not affect dimensions and functional clearances, and will have no adverse effects on other trades.
5. Claims for additional costs or time extension that may subsequently become apparent will be waived.
6. Payment will be made to the design team and/or other trades for changes to building design and/or construction.

C. Acceptance of a proposed product manufacturer prior to bidding does not constitute final acceptance of the substitution to imply that it meets all specific and significant qualities of the scheduled or specified product. The specified product shall remain the “basis of design” and all accepted product manufacturers remain subject to requirements therein.

1.08 EQUIPMENT DEVIATIONS

A. Where the contractor has proposed to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure or any other part of the design, all such redesign, and all new drawings and detailing required thereof, shall be prepared by the contractor at his own expense and submitted for approval by the engineer.

B. Where such accepted deviation requires a different quality, capacity, or arrangement of related equipment, ductwork, piping, wiring, or conduit from that specified or indicated on the drawings, the contractor shall furnish and install all such material and equipment required at no additional cost and with no additional time added to the contract.

1.09 SUBMITTALS FOR REVIEW

A. See Division 01 General Requirements, for additional submittal procedures.

B. Prior to delivery of any equipment or material to the jobsite, the contractor shall submit for review, detailed shop drawings and/or product data cut sheets of all equipment and materials required to complete the project. No material or equipment may be delivered to the jobsite or installed until the contractor has in his possession the reviewed submittals for the particular material or equipment.

C. Submittals shall include detailed, dimensioned cut sheets showing manufacturer, model, construction, quantity, size, arrangements, operating clearances, performance characteristics, and capacity. Each item of equipment proposed shall be a standard catalog product or custom modified version of an established manufacturer, and of equal quality, fit, finish, durability, and performance to those specified or scheduled.

D. Unless otherwise approved in advance, all submittals and resubmittals for each division shall be transmitted to the engineer at one time. Submittals shall be transmitted sufficiently in advance to allow ample time for review. Review will not commence until all submittals for a particular division are received. Partial submittals will be returned without review. Failure to submit with ample time for checking shall not entitle an extension of contract time.

E. Samples, drawings, specifications, catalogs, etc submitted for review, shall be properly labeled indicating contractors name and title of project, specific service and size range for which material or equipment is to be used, and section/article number of specifications governing, with model numbers and accessories clearly marked.

F. Review rendered on submittals does not in any way relieve the contractor's responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications. Conformance of substituted equipment shall be the sole responsibility of the contractor.

G. Review rendered shall not be considered as a guarantee of building conditions. The contractor is responsible for dimensions, which shall be confirmed at the job site; coordination of his work with that of other trades, quantities required, and the satisfactory performance of his work.

1.10 DELEGATED DESIGN SUBMITTALS

A. The contractor shall provide professional services or certifications by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations,

specifications, certifications, shop drawings, and other submittals prepared by such professional.

B. 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 for review.

C. The Owner and the Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by such design professionals.

D. The Engineer will review, approve, or take other appropriate action on submittals only for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents.

E. Work on the project shall not begin until submittals have been accepted by the Engineer and the Authority Having Jurisdiction.

1.11 DIGITAL SUBMITTALS

A. At the contractor's option, paperless electronic submittals may be transmitted in an Adobe PDF formatted file. Submittals shall be transmitted in logical groupings with each specification number and title (and article where applicable) identified in the file name. Electronic submittals and resubmittals are subject to all outlined requirements listed above.

B. When resubmitting, transmit the full and complete submittal section, such that a single reviewed and accepted submittal file will exist on the record and with the general contractor on the jobsite. Partial resubmittals and/or loose sheets will be summarily rejected.

C. Remove all rejected pages, pages not applicable to the submittal, and/or pages that are being changed for the resubmittal. Insert all new pages into the digital file in the appropriate locations, labeled and indicated as specified above.

D. Return the digital file with the same or similar identifying file name, including the specification section number and title, and article or paragraph numbers where applicable.

1.12 COOPERATION WITH OTHER TRADES

A. This contractor shall give full cooperation to other trades and shall furnish in writing to said trades, with copies to the engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where the work of the contractor will be installed in close proximity, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. In general, sanitary waste and vent and roof drains shall have precedence; ductwork shall have precedence over all other plumbing and piping, piping shall have precedence over conduit, etc.

C. If so directed by the engineer, the contractor shall prepare composite working drawings and sections at a suitable scale not less than a quarter inch, clearly showing how his work is to be installed in relation to the work of other trades. If the contractor installs his work before coordinating with other trades, so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

D. The contractor shall furnish other trades all necessary templates, patterns, setting plans, and shop details for the purpose of coordinating adjacent work or for the proper installation of common work and equipment.

1.13 MATERIAL AND WORKMANSHIP

A. All material and apparatus required for the work, except as specified otherwise, shall be newly manufactured, of best quality, and shall be furnished, delivered, erected, connected and finished in every detail. Where no specific kind of quality of material is given, a best-in-class standard article as approved by the engineer shall be furnished.

B. The contractor shall furnish the services of an experienced superintendent, who shall be continuously in charge of the installation of the work, together with all skilled workmen, fitters,

metal workers, welders, helpers, and labor required to unload, transfer, erect, connect, adjust, start, operate, and test each system.

1.14 GUARANTEES AND WARRANTEES

A. The contractor shall guarantee, in writing, that all work installed will be free from any and all defects in workmanship and/or materials; that all apparatus will develop capacities and characteristics specified; and that if, during a period of one year, or as otherwise specified from the date of substantial completion, any such defects in workmanship, material or performance appear, the contractor will remedy such defects within a reasonable time and without cost to the owner.

B. The contractor or manufacturer shall guarantee that individual items or groups of items furnished shall have capacities equal to or greater than that specified and shall be suitable for the intended application. Furnish manufacturer's written warranties on all equipment to the owner stating effective date of warranty.

C. In default thereof, the Owner may have such work done and charge costs to the contractor.

1.15 MANUFACTURER'S SPECIFICATIONS

A. Where these specifications require that a material, article, or apparatus shall be applied, installed, assembled, connected, cleaned, started, etc., "in accordance with the manufacturer's specifications, directions, or recommendations", said instructions shall have the same force and effect as though written in full in these specifications.

1.16 REMODEL WORK

A. Existing equipment and conditions shown on the drawings are indicated for informational purposes only. The contractor shall be responsible for visiting the site, and verifying conditions as they exist, and shall provide for the removal, relocation and/or reworking of any equipment affected (whether indicated or not) by the removal, addition, or reworking of existing walls, ceilings, pipes, ducts, equipment, etc. No change orders will be allowed for conditions that should be reasonably expected for the extent of remodel shown.

1.17 FIRE RATED ASSEMBLIES

A. The contractor shall be responsible for maintaining the integrity of all fire rated ceiling and wall assemblies. Where penetrations are required into ceilings or sections of ceilings are removed to install support members, the contractor shall be responsible for patching the ceiling with an approved fire rated wallboard. Tape, seal, texture and paint to match all surrounding surfaces. This shall apply to all new penetrations and any existing penetrations through-out the project.

1.18 ROOF PATCHING

A. All penetrations through existing roofing membranes shall be patched in an approved manner by a licensed and insured roofing subcontractor. Said contractor shall possess the necessary manufacturer's qualifications for repair to the specific existing brand of roofing material, and shall submit a copy of a manufacturer's “certificate of authorization” prior to construction.

PART 2 EXECUTION

2.01 PROTECTION

A. The contractor shall protect all work and material from damage by his work or workmen, and shall be liable for all damage thus caused.

B. The contractor shall be responsible for work and equipment until finally inspected, tested, and accepted; he shall protect material and equipment received on site which is not immediately installed.

C. All open ends of piping, ducts, and equipment shall be closed with temporary covers or plugs during storage and construction to prevent entry of dirt or obstructing material.

2.02 ACCESSIBILITY

A. The contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work.

He shall cooperate with the general contractor and all other trades whose work is in the same space, and shall advise the general contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required.

B. The contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Accessible equipment shall include but not be limited to, fire and smoke dampers, volume dampers, coils, valves, traps, clean-outs, motors, controllers, and drain points.

C. Provide metal access panels with screwdriver cam-locking device of required size and type to provide access to devices concealed in walls, ceilings, or furred-in spaces. Furnish access panels to the general contractor for installation as directed by this contractor. Location of these panels shall be communicated in sufficient time to be installed in the normal course of work.

D. Panel size shall be minimum 12" x 12" and larger as conditions may demand. Panels shall be of the type necessary for the particular wall or ceiling construction in which they occur and shall be approved for fire-rated assemblies where required.

2.03 FOUNDATIONS AND SUPPORTS

A. Furnish and install concrete pads under all pumps, compressors, and other rotating machinery, and all other equipment where foundations are indicated. All pads shall be extended 6 inches beyond machine base in all directions with top edge chamfered. Install 1/2" rebar reinforcing at 12” on center both directions, with steel dowel rods inset 6” into floors to anchor the pads. Cast-in-place concrete shall have a 28 day compressive strength of 4000 psi. Submit shop drawings for approval prior to construction.

B. All equipment, unless shown otherwise, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the engineer, not strong enough shall be replaced as directed.

C. This contractor shall furnish all temporary equipment such as ladders, scaffolding, rigging, hoisting, and services necessary for proper and safe execution of the work, and delivery onto the premises of any equipment and apparatus furnished.

2.04 CUTTING AND PATCHING

A. The general contractor shall provide for all openings in construction. The mechanical contractor shall coordinate sizes and locations of openings and shall be responsible for all cutting and patching as necessary when sizes or locations are incorrectly communicated to the general contractor. Patching shall match adjacent surfaces. No structural members shall be cut without the approval of the engineer, and all such cutting shall be done in a manner directed by him.

B. Damages to new and existing masonry or brick veneers as the result of cutting or core drilling for penetrations of ductwork, grilles, louvers, piping, etc shall be repaired by an independent contractor without additional cost to the owner. Said contractor shall be regularly engaged in the masonry business with documented experience of at least five years.

2.05 SLEEVES AND PLATES

A. Sleeves shall be provided for all piping passing through concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Provide and locate all sleeves and inserts required before the floors and walls are built, or be responsible for the cost of cutting and patching required for pipes where sleeves and inserts penetrate existing construction, or where they were not installed or incorrectly located.

B. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves are located in fire-rated assemblies, fill space between pipe and sleeve with a listed and approved "fire stop" material. Where sleeves are placed in exterior walls, the space between the pipe and the sleeve shall be sealed with a weather tight caulk.

C. Where sleeves are located in fire-rated assemblies, fill space between pipe and sleeve with a listed and approved "fire stop" material. Where sleeves are placed in exterior walls, the space between the pipe and the sleeve shall be sealed with a weather tight caulk.

D. Check floor and wall construction finishes to determine proper length of sleeves for various locations. Terminate sleeves flush with walls, partitions and ceilings. In chase areas where pipes are concealed, terminate sleeves flush with floor. In all mechanical rooms and chases where pipes are exposed, extend sleeves 2" above finished floor.

E. Fasten sleeves securely in floors, walls, etc. so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the sleeve during construction.

F. Escutcheon plates shall be provided for all exposed uninsulated pipes passing through walls, floors, and ceilings. Plates shall be nickel plated, of the spring ring type, sized to match the pipe. Where plates are provided for pipes passing through sleeves that extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

G. This contractor shall be responsible for providing flashing for all required exterior penetrations. It is this contractor's responsibility to have reviewed the architect's drawings for roof and wall construction types and to provide the appropriate penetration flashings for installation by the general contractor. All penetrations shall be sealed weather-tight.

2.06 FIRE SAFE SEALANTS

A. Provide and install an elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct and piping penetrations through walls and floors, and having a UL tested and approved fire-resistance rating for the intended construction.

2.07 LUBRICATION OF EQUIPMENT

A. The contractor shall properly lubricate all pieces of equipment before turning the building over to the owner. A tag shall be attached to each motor showing the date of lubrication and lubricant needed.

2.08 QUIET OPERATION AND VIBRATION

A. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the engineer. In the case of moving machinery, sound or vibration noticeable inside its own room will be considered objectionable.

B. Conditions shall be corrected in an approved manner by the contractor at his expense. Vibration control shall be by means of approved vibration eliminators in a manner as recommended by the manufacturer of the eliminators.

2.09 MOTORS

A. Motors shall be built in accordance with the latest NEMA standards and as specified. Motors shall be tested in accordance with standards of ASA C50 and conform thereto for insulation resistance and dielectric strength.

B. Each motor shall be provided with a conduit terminal box and adequate starting and protective equipment as specified or required. The capacity shall be sufficient to operate associated driven devices under all conditions of operations and load without overload, at the horsepower indicated or specified.

C. All motors rated greater than 1000 watts shall have a power factor of not less than 85% at rated load.

2.10 ELECTRICAL CONNECTIONS

A. The electrical contractor will furnish and install all wiring except temperature control wiring, equipment control wiring which does not conduct full load motor current, and interlock wiring. The electrical contractor will furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters.

B. The electrical contractor will furnish and install all starters not factory mounted on equipment.

C. Control relay and control transformers shall be furnished under the mechanical contract except where furnishing such items is specifically required under the electrical specifications and/or drawings.

PART 3 CLOSEOUT

3.01 CLEANING AND FINISHING

A. The contractor shall go over his work and clean all equipment, ductwork, fixtures, piping, etc.

B. Wipe down exterior surfaces, vacuum, wash, and clean interiors of all fan cabinets, air handlers, etc.

C. Clean all dirt and debris from mechanical spaces, within and around all equipment (regardless of fault or pre-condition).

3.02 SYSTEM OPERATION

A. The contractor shall provide allowance in his bid to demonstrate that each system operates according to the specification. The contractor shall arrange to have all subcontractors (temperature control, sheet metal, plumbing, balancing, etc.) available to demonstrate to the engineer that each system performs properly.

B. If the equipment is installed improperly, is found to be faulty, or the contractor's personnel or subcontractors are not available and the demonstration requires more than one visit to the site, this contractor shall be responsible for additional time incurred by the engineer and agrees that the owner may deduct hourly fees from the amount otherwise due the contractor.

3.03 RECORD DRAWINGS

A. The contractor shall maintain a complete set of plumbing and mechanical drawings at the site, with all changes, etc, marked neatly thereon in a contrasting color. This set shall not be used for any other purpose. Keep the drawings current at all times.

B. At the completion of the project, the contractor shall record all changes on a clean set of drawings and present this set to the engineer. This set shall be clearly marked "Record Drawings" and dated.

3.04 OPERATING INSTRUCTIONS

A. Upon completion of all work and all tests, the contractor and his subcontractors shall furnish the necessary skilled labor and helpers for demonstrating operation of the system and equipment for at least one 8-hour day, or as otherwise specified.

B. During this period, instruct the Owner or his representative fully in the operation, adjustment, and maintenance of all equipment furnished. Give at least 48-hours notice to the Owner and Engineer in advance of this period.

3.05 MAINTENANCE MANUAL

A. This contractor shall furnish a minimum of three (3) operation and maintenance manuals. Each manual shall include a title sheet showing the engineering firm, general contractor, plumbing contractor, sheet metal contractor, and temperature control contractor. List phone numbers and addresses for all firms. Each manual shall also consist of the following, but is not limited to:

1. Table of contents.
2. Mechanical written guarantees.
3. List of all mechanical equipment suppliers.
4. Maintenance items and frequency of maintenance.
5. Written sequence of equipment operation (general description).
6. Equipment shop drawings and manufacturer service books.
7. Temperature control schematics.
8. Balancing and start-up reports.
9. Cleaning and treatment certifications.
10. Air and water filter replacement list.
11. Plumbing fixture shop drawings.
12. Parts list on all faucets and flush valves.

B. The contractor shall supply all shop drawings, part lists, and manufacturer's operation and maintenance literature. All type written pages shall be inserted in “plastic sheet protectors” and each section separated with tabbed dividers. Three-ring or D-ring "presentation type" binders shall be used, with the project title and date in protected plastic sleeves under the cover and the end.

END OF SECTION

SECTION 20 0513 - COMMON MOTOR REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors

B. Three phase electric motors.

1.02 DEFINITIONS

A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

B. Field-Installed Motor: A motor installed a Project site and not factory installed as an integral component of motorized equipment.

1.03 SUBMITTALS

A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

C. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.

C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

1.05 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
   1. Compatible with the following:
      a. Magnetic controllers.
      b. Multispeed controllers.
      c. Reduced-voltage controllers.
   2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
   3. Matched to torque and horsepower requirements of the load.
   4. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

PART 2 PRODUCTS

2.01 MOTOR CHARACTERISTICS

A. Motors 3/4 HP and Larger: Three Phase.

B. Motors Smaller Than 3/4 HP: Single Phase.

C. Frequency Rating: 60Hz.

D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.

G. 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.

2.02 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium as defined in NEMA MG 1.

C. Stator: Copper windings, unless otherwise indicated.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Regreasable, shielded, anti-friction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. 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.

I. Enclosure: Cast iron for motors 7.5 HP and larger; rolled steel for motors smaller than 7.5 HP.

2.03 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motor Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Designed with critical vibration frequencies outside operating range of controller output.
   2. Energy and premium efficiency motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Provide optional motor shaft grounding rings on all motors 5 HP and larger.

2.04 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:
   1. Permanent-split capacitor.
   2. Split-phase start, capacitor run.
   3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 HP and smaller only.

C. 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.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.

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

3.02 FIELD-INSTALLED MOTOR INSTALLATION

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

3.03 FIELD QUALITY CONTROL FOR FIELD-INSTALLED MOTORS

A. Prepare for acceptance tests.
   1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
   2. Verify bearing lubrication.
   3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
   4. Test interlocks and control and safety features for proper operation.
   5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

END OF SECTION

SECTION 20 0517 - SLEEVES AND SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sleeves.

B. Sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's catalog literature for each for each type of product indicated.

1.04 COORDINATION

A. Coordinate installation of sleeves with size, location, and installation of service utilities.

B. Coordinate installation of sleeves with the installation of concrete walls, masonry walls, and concrete floor and roof slabs.

PART 2 PRODUCTS

2.01 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   1. Advance Products & Systems, Inc; apsonline.com.
   2. Metraflex Company; metraflex.com.
   3. Pipeline Seal and Insulator, Inc; gptindustries.com.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

C. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

D. Pressure Plates: Carbon steel.

E. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.02 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to forms.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in concrete and masonry walls, concrete floors, and concrete roof slabs as new walls and slabs are constructed.
   1. Extend sleeves installed in floors of mechanical equipment areas, plumbing and piping chases, or other wet areas 2 inches above finished floor level.
   2. In all other locations, cut sleeves to length for mounting flush with both surfaces. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

4. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

C. Escutcheon Plates: Install one-piece or split hinge metal plates for pipes passing through floors, walls, and ceilings in exposed areas. Provide polished stainless steel or chrome plated escutcheons in finished spaces and metal plates with paint finish in unfinished areas.

3.02 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. Sleeves are not required for core drilled holes.
   1. Select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls. Sleeves are not required for core drilled holes.
   2. Select type, size, and number of sealing elements required for piping material and size, and for sleeve ID or hole size.
   3. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve.
   4. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Exterior Concrete Walls below Grade:
   1. Piping NPS 6 and Smaller: Cast-iron wall sleeves with sleeve-seal system.
   2. Piping Larger than NPS 6: Not applicable.

B. Concrete Slabs-on-Grade:
   1. Piping NPS 6 and Smaller: Cast-iron wall sleeves with sleeve-seal system.
   2. Piping Larger than NPS 6: Not applicable.

C. Concrete and Masonry Walls above Grade:
   1. Piping NPS 6 and Smaller:
      a. Cast-iron wall sleeves.
      b. Galvanized-steel-pipe sleeves.
   2. Piping Larger than NPS 6: Not applicable.

D. Concrete Slabs above Grade:
   1. Piping NPS 6 and Smaller:
      a. Galvanized-steel-pipe sleeves for wet areas.
      b. Molded-PE or -PP sleeves for all others.
   2. Piping Larger than NPS 6: Not applicable.

END OF SECTION

SECTION 20 0518 - ESCUTCHEONS AND PLATES

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Escutcheons.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's catalog literature for each for each type of product indicated.

1.04 COORDINATION

A. Coordinate installation escutcheons and plates with installation of piping and ductwork.

PART 2 PRODUCTS

2.01 ESCUTCHEONS

A. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   1. Brass Craft Manufacturing; brasscraft.com.
   2. Watts Water Technologies; watts.com.
   3. Keeney Manufacturing; keeneymfg.com

B. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

E. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed rivet hinge, and spring-clip fasteners.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install floor plates for piping penetrations of equipment room floors.

C. Install escutcheons with inside diameter to closely fit around pipe, tube, and insulation of insulated piping and with outside diameter that completely covers opening.

3.02 ESCUTCHEON SCHEDULE

A. Escutcheons for Exposed New Piping in Finished Areas:
   1. Bare Piping: One-piece, cast-brass type with polished, chrome-plated finish.
   2. Insulated Piping: One-piece, stamped-steel type.
   3. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   4. Escutcheons are not required for concealed piping, piping in unfinished service areas, or piping in equipment rooms.

B. Escutcheons for Exposed Existing Piping:
   1. Bare Piping: Split-casting brass type with polished, chrome-plated finish.
   2. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
   3. Escutcheons are not required for concealed piping, piping in unfinished service areas, or piping in equipment rooms.

END OF SECTION

SECTION 20 0523 - GENERAL DUTY VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.

B. Check valves.

C. Drain valves.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's catalog literature for each for each type of product indicated.

1.04 COORDINATION

A. Coordinate installation of ball valves, butterfly valves, and check valves with installation of piping.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature.
   3. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads on threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valves.
   5. ASME B16.18 for solder-joint connections.
   6. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: Comply with NSF 61 and NSF 372 for potable-water applications.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types: Hand-lever for quarter-turn valves NPS 6 and smaller.

I. Valves in Insulated Piping: Include 2-inch stem extensions/extended necks.

2.02 MANUFACTURERS

A. 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. Conbraco: apollovalves.com.
2. Milwaukee: milwaukeevalve.com.
3. Nibco: nibco.com.

2.03 BALL VALVES

A. Size 2 inch and Smaller: MSS SP-110, Class 150, 600 psi CWP, bronze two-piece body, chrome plated brass or stainless steel ball, TFE seats and stuffing box ring, blow-out proof bronze or stainless steel stem, with lever handle. Suitable for water, oil, or gas (WOG) services. Threaded or soldered ends.

2.04 BUTTERFLY VALVES

A. Size 2-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, stainless steel stem, aluminum bronze with resilient replaceable EPDM or NBR seat, lever operated with 10-position throttling plate. Lug style or grooved ends capable for use as dead-end service isolation valves at full pressure without the use of additional flange.

2.05 CHECK VALVES

A. Size 2 Inch and Smaller: MSS SP-80, Class 125, wye-pattern swing type, bronze body, bronze trim, renewable TFE seat disc. Soldered or threaded ends.

B. Size 2-1/2 Inch and Larger: MSS SP-71, Class 125, swing type, iron body, bronze trim, bronze seat disc, renewable disc seal and seat. Threaded, flanged, or grooved ends.

C. For vertical lines or pump discharge: MSS-SP126, Class 125, spring-actuated, iron body, bronze trim, bronze disc, renewable seals, and stainless steel spring. Threaded, flanged, or grooved ends.

2.06 SPRING LOADED CHECK VALVES

A. (ANL) 2 Inch and Smaller: Bronze body, Class 125 (200 psi WOG) (NIBCO T(S)-480).

2.07 DRAIN VALVES

A. Ball Valve Type, Hose-End Drain Valves:
   1. Bronze ball valve as specified above.
   2. Outlet: Threaded, short nipple, with garden hose thread complying with ASME B1.20.7, with cap and chain.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Spring Loaded Check Valves: In horizontal or vertical position, between flanges.

3.03 VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered ends.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
   3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
   4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded ends.

3.04 DOMESTIC WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Two-piece, bronze ball valves with full port and bronze [or stainless-steel] trim.
   2. Bronze swing check valves, [Class 125] [Class 150], bronze disc with soldered or threaded end connections.

END OF SECTION

SECTION 20 0529 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal pipe hangers and supports.

B. Trapeze pipe hangers.

C. Metal framing systems.

D. Thermal shield inserts.

E. Fastener systems.

F. Equipment supports.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's catalog literature for each for each type of product indicated.

1.04 COORDINATION

A. Coordinate installation of hangers and supports with installation of piping, equipment, and ductwork.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. 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.

B. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer. Submit analysis data, signed and sealed, upon request.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.03 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.

2.04 METAL FRAMING SYSTEMS

A. Description: Shop or field fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

1. Standard: Comply with MFMA-4.
2. Channels: Minimum 12-gauge, 1-5/8-inch, continuous slotted steel channel with inturned lips and epoxy-coated finish.
3. Channel Nuts: Formed or stamped steel nuts designed to fit into channel slot and, when tightened, prevent slipping along channel.

4. Pipe Clamps: Electro-galvanized carbon steel strut clamp with welded fastener and nylon locknut.
5. Coupling: High-strength thermoplastic polypropylene insulation insert molded to fit clamp halves.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.05 THERMAL SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: [ASTM C 552, Type II cellular glass with 100-psig (688-kPa)] [or] [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa)] minimum compressive strength and vapor barrier.

B. Manufacturers:
1. Pipe Shields, Inc: pipeshields.com.
2. Thermal Pipe Shields, Inc: thermalpipeshields.com.
3. Value Engineered products: valueng.com.

2.06 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.07 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.08 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon-steel shapes.

2.09 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.01 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, 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. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal 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, and at changes in direction of piping.

K. 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. Use thermal-hanger shield insert with clamp sized to match outside diameter of insert.
   b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Pipes 2-inch and Larger: Include reinforced calcium silicate insulation inserts of length at least as long as protective shield.
3. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

O. Rigidly mounted domestic piping (where allowed) shall be secured to 12 gauge 1-5/8 inch slotted channel framing with insulated strut clamps.

P. Metal stud insulating pipe clamps shall be used to isolate piping away from steel stud framing.

3.02 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.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap. Remove welding flux immediately.

3. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 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.

3.05 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in sections specifying piping systems and equipment. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system sections.

B. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

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 thermal-hanger shield inserts for insulated piping and tubing.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. 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.
   3. 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.
   4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 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.

H. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system sections.

I. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system sections.

J. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 20 0553 - PIPING AND EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment labels.

B. Pipe and duct labels.

C. Warning labels.

D. Ceiling grid tags.

1.02 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's catalog literature for each for each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve Numbering Schedule: For each piping system to include in maintenance manuals.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1 for lettering size, length, colors, and viewing angles of identification devices.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustic ceilings and similar concealment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   1. Brimar Industries; pipemarkers.com.
   2. Carlton Industries; carltonusa.com.
   3. Craftmark Pipe Markers; craftmarkid.com
   4. Graphic Products; graphicproducts.com
   5. Seton Company; seton.com.

2.02 EQUIPMENT LABELS

A. Description: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   1. Color: Black background with white lettering.
   2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   3. Minimum Label Size: Length and width vary for required label content, but not less than 3 by 1 inch.
   4. Minimum Letter Size: 1/2 inch. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   5. Fasteners: Stainless-steel rivets or self-tapping screws.
   6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Contents: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified.

2.03 PIPE AND DUCT LABELS

A. Description: Preprinted, color-coded, fade-resistant, vinyl material with lettering indicating service, and showing flow direction.
   1. Colors and Lettering Size: Comply with ANSI A13.1 for piping; White lettering on green background for air ducts.
   2. Flow-Direction Arrows: Integral with piping or duct system service lettering to accommodate both directions or as separate unit on each pipe or duct label to indicate flow direction.
   3. Adhesive: Contact-type, permanent-adhesive backing, compatible with carbon steel piping, plastic pipe, all service jackets, aluminum jacketing, and galvanized sheet steel.

B. Pipe Label Contents: Include identification of piping using same designations as used on Drawings and arrows indicating flow direction.

C. Duct Label Contents: Include identification of air service using same designations as used on Drawings and arrows indicating flow direction.

2.04 WARNING SIGNS AND LABELS

A. Description: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   1. Color: Red background with white lettering.
   2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   3. Minimum Label Size: Length and width vary for required label content.
   4. Minimum Letter Size: 3/4 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   5. Fasteners: Stainless-steel rivets or self-tapping screws.
   6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Contents: Include caution and warning information plus emergency notification instructions.

2.05 CEILING GRID TAGS

A. Description: Vinyl self-adhesive labels, for installation on ceiling grid for equipment located above lay-in ceiling.
   1. Color: Black lettering on a white background.
   2. Size: 3/4-inch wide by 3-mil thick, variable length.

B. Label Contents: Include equipment's drawing designation or unique equipment number.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, and paints.

3.02 GENERAL INSTALLATION 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.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment using fasteners or adhesive.

B. Identify control panels, major control components, fire dampers and smoke dampers.

C. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals in areas of congested piping and equipment.

3.05 DUCT LABEL INSTALLATION

A. Locate duct labels in mechanical rooms near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling systems.

3.06 CEILING TAG INSTALLATION

A. Affix ceiling grid tags to locate valves, dampers, control devices, and other concealed equipment above an access door in the ceiling. Locate in corner of the access door.

END OF SECTION

SECTION 20 0590 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Balancing Air Systems:
   1. Constant-volume air systems.

B. Balancing Plumbing Piping Systems:
   1. Domestic hot water flow systems.

C. Testing, Adjusting, and Balancing Equipment:
   1. Motors.
   2. Heat exchangers.
   3. Heat-transfer coils.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. Associated Air Balance Council:
   1. AABC MN-1 - AABC National Standards for Total System Balance.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

D. National Environmental Balancing Bureau:
   1. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

E. Sheet Metal and Air Conditioning Contractors' National Association:
   1. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing.

1.04 ACTION SUBMITTALS

A. Qualification Data: Submit documentation that the testing and balancing agency and field specialists meet the qualifications specified in the quality assurance article.

B. Strategies and Procedures Plan: At least 6-weeks prior to the start of testing, adjusting, or balancing activities, submit strategies and step-by-step procedures as specified in the preparations article.

1.05 INFORMATIONAL SUBMITTALS

A. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

B. Instrument Calibration Reports: To include instrument type and make, serial number, application, dates of use, and dates of calibration.

C. Field Deficiency Reports: Include defects and deficiencies that will or could prevent proper testing and balancing. Beginning or continuing with the work indicates acceptance of examined conditions.

1.06 CLOSEOUT SUBMITTALS

A. Final Report: Prepare a certified written report to meet the requirements specified in the final report article at the end of this section. Tabulate and divide the report into separate sections for tested systems and balanced systems.

1.07 QUALITY ASSURANCE

A. TAB Agency Qualifications:
   1. An independent company specializing in the measurement, testing, adjusting, and balancing of plumbing and mechanical systems, not affiliated with any other contractor or equipment supplier on the project.
   2. Having a minimum of 5-years documented experience with installations of similar size and complexity. Submit a list including reference contacts.
   3. Certified by one of the following:
      a. AABC: Associated Air Balance Council: aabchq.com.
      b. NEBB: National Environmental Balancing Bureau: nebb.org.
      c. TABB: Testing, Adjusting, and Balancing Bureau: tabbcertified.org.
   4. TAB Field Supervisor and Technician: Employee of the TAB agency and certified by the same organization.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
   4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced, and complete work prior to the date of substantial completion of the project, phases or sub-phases.

C. Where hvac systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling, testing, and inspection procedures with the authorities having jurisdiction.

D. Minimum Fan Speed:
   1. The minimum fan speed setting within each variable speed drive itself shall be optimized in the field to be as low as possible while avoiding inertial stalling.
   2. The minimum pump speed setting within each variable speed drive itself shall be no less than 30% to protect the seal from premature failure.

3.02 TOLERANCES

A. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to the space. Adjust outlets and inlets in the space to within plus or minus 10 percent of design.

B. Hydronic Systems: Adjust heating and/or cooling water flow rates to within plus or minus 10 percent of design.

C. Maintaining design pressure relationships shall have priority over the tolerances specified above.

3.03 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in system designs that may preclude proper testing and balancing of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these devices are applicable for intended purpose and are accessible.

C. Examine ceiling air plenums used for return or relief air, to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

D. Examine approved equipment submittal performance data including fan curves and pump curves. Relate performance data to project conditions and requirements, to evaluate undesired or unpredicted conditions that may cause reduced capacities in all or part of a system.

E. Examine system and equipment installations and verify that field quality control testing, cleaning, and adjusting specified in individual sections have been performed.

F. Examine equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

G. Examine terminal units, such as fan coil units, and verify that they are accessible and their controls are connected and functioning.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine system pumps to ensure absence of entrained air in the suction piping.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Examine test reports specified in individual system and equipment sections.

3.04 PREPARATION

A. Prepare a strategies and procedures plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Sample forms with specific identification for all equipment.
   4. Instrumentation to be used.

B. Perform checks of systems and equipment to verify system readiness for testing and balancing work. At a minimum, include the following:
   1. Airside:
      a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
      b. Duct systems are complete with terminals installed.
      c. Volume, smoke, and fire dampers are open and functional.
      d. Fans are operating, free of vibration, and rotating in correct direction.
      e. Variable-frequency controller startup is complete and safeties are verified.
      f. Automatic temperature control systems are operational.
      g. Suitable access to balancing devices and equipment is provided.
      h. Clean filters are installed.

3.05 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with one of the following:
   1. AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
   4. Maintain at least one copy of the standard to be used at the project site at all times.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for the TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with the same material and thickness as used to construct the ducts.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to applicable specifications.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable permanent identification material to show final settings.

D. Measure and report testing and balancing measurements in inch-pound (IP) units only.

3.06 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Measure and adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

D. For variable-air-volume systems, develop a plan to simulate diversity. Full flow in one section of the system may be simulated by temporary restriction of flow to other sections.

E. Determine the best locations in main and branch ducts for accurate airflow measurements.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check ductwork and equipment for airflow blockages.

J. Check condensate drains for proper connections and function.

3.07 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by the fan manufacturer.
   1. Measure total airflow as follows.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
      d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report artificial loading of filters at the time static pressures are measured.
   3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct and major branch ducts to indicated airflows.
   1. Measure airflow of main and branch ducts.
   2. Adjust branch duct volume dampers for specified airflow.
   3. Re-measure each main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
   1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   2. Measure and adjust inlets and outlets for specified airflow.
   3. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Test system in economizer mode. Verify proper operation and adjust if necessary.
5. Measure and record all operating data.
6. Record final fan-performance data.
7. Mark all final settings.

3.08 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

A. Prepare test reports for pumps and heat exchangers. Obtain approved submittals and manufacturer recommended testing procedures. Crosscheck the summation of required heat exchanger flow rates with pump design flow rate.

B. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

C. Verify that motor starters are equipped with properly sized thermal protection.

D. Check flow-control valves for proper position.

3.09 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating, rpm, phase and hertz.
3. Nameplate and measured voltage, each phase.
4. Nameplate and measured amperage, each phase.
5. Starter size and thermal-protection-element rating.
6. Service factor and frame size.

3.10 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering and leaving air temperatures.

C. Record fan and motor operating data.

3.11 PROCEDURES FOR HEAT TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:
1. Airflow.
2. Entering and leaving water temperature.
3. Water pressure drop for air handler coils.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.

B. Measure, adjust, and record the following data for each electric heating coil:
1. Airflow.
2. Entering and leaving air temperature at full load.
3. Voltage and amperage input of each phase at full load.
4. Fuse or circuit breaker rating for overload protection.
5. Calculated kilowatt at full load.
6. Nameplate data.

C. Measure, adjust, and record the following data for each refrigerant coil:
1. Airflow.
2. Dry-bulb temperature of entering and leaving air.
3. Wet-bulb temperature of entering and leaving air.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Report Contents: In addition to certified field-report data, include the following:
1. Manufacturers test data.
2. Pump curves and fan curves.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, excluding shop drawings and product data.

C. Report Data: In addition to form titles and entries, include the following data:
1. Title page with project name, address, and altitude, name and contact information of the TAB agency, project engineer and contractors list, and the report date.
2. Signature of the TAB supervisor who certifies and is responsible for the report.
3. Table of Contents with pages defined for each section of the report.
4. Nomenclature sheets for each item of equipment.
5. Data for terminal units, including manufacturer's name, type, size, and fittings.
6. Notes to explain why certain final data in the body of reports vary from indicated values.
7. Test conditions for fans and pump performance forms including the following:
    a. Conditions of filters.
    b. Cooling coil, wet and dry bulb conditions.
    c. Face and bypass damper settings at coils.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Settings for outdoor, return, and exhaust air dampers.
    f. Settings for supply air, static-pressure controller.
    g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed in rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

F. Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in square feet.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

G. Air-Terminal-Device Reports:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone served.
c. Apparatus used for test.
d. Number from system diagram.
e. Make, type, size, and model number.
f. Effective area in square feet.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flow-meter type.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
a. Unit identification.

b. Location and service.
c. Make, model, size, and serial number.
d. Water flow rate in gpm.
e. Water pressure differential in feet of head or psig.
f. Pump speed in rpm.
g. Impeller diameter in inches.
h. Motor make and frame size.
i. Motor horsepower and rpm.
j. Voltage at each connection.
k. Amperage for each phase.
l. Full-load amperage and service factor.
m. Seal type.

2. Test Data (Indicated and Actual Values):
a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm .
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm (L/s).
j. Voltage at each connection.
k. Amperage for each phase.

J. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 VERIFICATION OF TAB REPORT

A. The Owner, engineer, construction manager, or commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

B. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

C. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

D. If TAB work fails, proceed as follows:
1. The TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

END OF SECTION

DIVISION

21

FIRE PROTECTION SYSTEMS

SECTION 21 1313 - FIRE PROTECTION SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install an automatic fire sprinkler system and fire pump system to protect all areas of the Old Stoney building as indicated herein and as shown on the drawings. Connect fire pump system to a municipal water supply to ensure full and sustained water discharge immediately from sprinkler heads for the required duration when opened by fire at rated heat temperatures. Water supply shall conform to NFPA water supply requirements. Water supply characteristics at point of connection to the water main is as follows: 51 Static, 20 Residual with 902 GPM flowing.

B. All portions of the systems shall be installed in accordance with the drawings, details, and specifications and as required by jurisdictional authorities and codes. The position is taken that the Owner is entitled to a project which meets or exceeds the minimum requirements of nationally recognized fire protection standards. All efforts and installations shall be directed toward this end. Where there is conflict between the contract drawings and/or specifications, and the requirements of the jurisdictional authorities or codes, the conflict shall be brought to the attention of the Engineer at least ten (10) days prior to bidding or be resolved at no cost to the Owner. If the contractor has not identified conflicts to the Engineer, he shall be responsible for complying with the most restrictive (expensive) methods.

C. The intent of these specifications is to describe the complete systems to be installed, including minor details of work or materials not specifically mentioned or shown, but necessary for the successful operation and completion of the installation. The contractor shall be responsible for complete design and installation of the system as required by applicable Codes and Standards.

D. Install double interlock preaction system for protection of the first floor and the sub-basement work area. Install automatic wet pipe system to protect all heated interior areas of the building not protected by the double interlock preaction system. The unheated combustible attic space, sub-basement mechanical room and any other unheated areas of the building shall be protected with an automatic dry pipe system.

E. Provide dry sidewall sprinkler protection below the landings of the exterior emergency exit stairs.

F. Work to be performed under this section shall include, but not be limited to the following:
   1. Automatic wet pipe fire sprinkler system.
      a. Pipe and fittings.
      b. Hangers and supports.
      c. Earthquake bracing.
      d. Valves.
      e. Alarms.
      f. Flow and Tamper Switches.
      g. Specialties.
   2. Automatic dry pipe fire sprinkler system.
      a. Pipe and fittings.
      b. Hangers and supports.
      c. Earthquake bracing.
      d. Valves.
      e. Waterflow Alarms.
      f. Pressure and Tamper Switches.
      g. Specialties.
   3. Automatic double interlock preaction fire sprinkler system.
      a. Pipe and fittings.
      b. Hangers and supports.
      c. Earthquake bracing.
      d. Valves.
      e. Waterflow Alarms.

f. Pressure and Tamper Switches.
g. Specialties.

4. Fire Pump System
   a. Motor
   b. Controller
   c. Pump
   d. Base
5. Pressure Maintenance Pump
   a. Motor
   b. Controller
   c. Pump
   d. Base
6. Fire Pump Accessories
   a. Flow metering device
   b. Eccentric tapered suction reducer
   c. Concentric tapered discharge increaser
   d. Hose valves
   e. Caps and chains
   f. Hose valve header
   g. Pressure gauges
   h. Circulation relief valve
   i. Automatic air release valve
   j. Splash shield
   k. Ball drip valve
   l. Coupling guard

G. Furnish and install an automatic fire protection system of type or types required in the following areas:
   1. Automatic Wet Pipe Fire Sprinkler System: In all heated areas of the building.
   2. Automatic Dry Pipe Fire Sprinkler System: In all un-heated areas of the building.
   3. Automatic Double Interlock Preaction Fire Sprinkler System: In the entire first floor space and the sub-basement work area.
   4. Fire Pump System: In Fire Pump room.

1.02 RELATED WORK

A. All work performed under this section of the specifications shall be subject to the requirements of both the General and Special Conditions.

B. Related work specified elsewhere:
   1. Fire Alarm System Section 28 31 05

C. Examine the above referenced specification parts thoroughly before submitting a proposal for accomplishment of work in this section.

1.03 REGULATORY AGENCIES

A. The term jurisdictional authority used in this section of the specification shall include, as applicable, but not be limited to the following:
   1. City of Sundance Public Works Department.
   2. City of Sundance Volunteer Fire Department.
   3. State of Wyoming Fire Marshal.
   4. Owner.

B. The design and installation of all systems of fire protection shall conform to all requirements of applicable codes and publications herein defined:
   1. International Building Code (2015)
   2. International Fire Code (2015)
   3. NFPA#13 (2013)
   4. NFPA #20 (2013)

5. All State and local ordinances
6. Underwriters' Laboratories
7. American Society of Testing Materials
8. American National Standards Institute
9. Occupational Safety and Health Administration

1.04 SUBMITTALS

A. Delegated Design Submittals
   1. The contractor shall provide professional services or certifications by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, shop drawings, and other submittals prepared by such professional.
   2. 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 for review.
   3. The Owner and the Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by such design professionals.
   4. The Engineer will review, approve, or take other appropriate action on submittals only for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents.
   5. Work on the project shall not begin until submittals have been accepted by the Engineer and the Authority Having Jurisdiction.

B. Shop Drawings
   1. Working drawings (floor plans - detailed working drawings), showing dimensions, ducts, lights, or other items affecting the fire protection systems shall be submitted to jurisdictional agencies and the Engineer for review and approval. All items identified in NFPA #13 and NFPA #20 for proper working drawings shall be complied with. After approvals from jurisdictional agencies have been returned to the Contractor, they shall be submitted to the Engineer for final system approval.
   2. Working drawings shall be prepared in AutoCAD or compatible software.
   3. The working drawings shall be signed and sealed by the Professional Engineer responsible for their preparation.
   4. Engineer's review will be for general location and compliance with design intent only. It will be the Contractor's responsibility to check his drawings for interferences and to do shop fabrication from measurements taken at the job site. It will be the Contractor's responsibility to check the drawings for interferences and coordinate with all building trades.

C. Catalog/Product Information
   1. Full catalog information shall be submitted to the jurisdictional agencies and the Engineer for review and approval for all materials intended for use on this project.

D. Hydraulic Calculations
   1. Hydraulic calculations shall be submitted for approval. Calculations shall be provided to substantiate the pipe sizes shown on shop drawings. Should the Engineer question the pipe size for any area, the Contractor shall provide additional calculations to the satisfaction of the engineer. The hydraulic calculations shall be signed and sealed by the Professional Engineer responsible for their preparation.

E. Installer's Qualifications
   1. All systems of fire protection shall be installed by a licensed (for the location of installation) Fire Protection Contractor, fully experienced in fire protection installation as required and specified herein.
   2. Fire Protection Contractors may be required to provide in writing specific information as to successfully completed projects and references to show cause as to why they should be considered acceptable to the engineer.

F. Close-Out
   1. Record Drawings required per paragraph 1.06 and Operation and Maintenance Manuals required per paragraph 1.07, shall be submitted for approval.

1.05 JOB CONDITIONS

A. The Contractor shall investigate the structural, mechanical, electrical, and finished conditions affecting the piping, and shall install the piping and equipment accordingly; furnishing required fittings, offsets and accessories as required for a complete installation. Route fire protection piping to avoid interference with ductwork, piping, lighting and structure. In the event it becomes necessary to make field changes in pipe locations due to building construction, the Contractor shall consult with the Professional Engineer responsible for the design before making any changes. Any such changes required shall be made without added cost to the Owner.

B. The Contractor shall determine, and be responsible for, the proper locations and type of inserts for hangers, chases, sleeves, and other openings in the construction required for fire protection work, and shall obtain this information well in advance of the construction progress to avoid delay of the work.

C. Contractor is responsible for final locations of piping and equipment as well as field routing which shall be coordinated with all other trades within the building. Contractor shall review all contract documents including architectural, structural, mechanical, electrical, etc. for actual contract conditions. Exposed piping shall be routed as tight to structure as possible. Coordinate exposed pipe routing with the Architect to minimize aesthetic impact to the building.

D. All fees and permits specifically required for fire protection work, not obtained by others as specified elsewhere shall be applied for and paid for by this Contractor.

1.06 RECORD DRAWINGS

A. One approved set of drawings shall be maintained on the job at all times.

B. One set of “As-Built” drawings shall be kept on the job at all times. “As-Built” drawings shall be kept current daily. “As-Built” drawings shall be available at all times to Engineer for review and use.

C. One reproducible set of “As-Built” drawings shall be provided to the Owner upon completion of the work and included in the Operation and Maintenance Manuals as indicated in section 1.07.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Three (3) sets of operating and maintenance instructions shall be provided to the Owner upon completion. Manuals will include, as a minimum, the following:
   1. “As-Built” Drawings
   2. Catalog cut sheets of all materials installed
   3. Equipment maintenance manuals
   4. Hydraulic Calculations
   5. Acceptance Test Certificate
   6. Certification of Owner Training (see section 1.8)
   7. Contractor Guarantee and Warranty (see section 1.9)
   8. “As-Built” AutoCAD drawing (.dwg) file or equal on CD

B. One (1) original copy of NFPA #25 (2011) shall be provided with the Operation and Maintenance Manuals for the Owner.

1.08 TRAINING

A. The Fire Protection Contractor shall instruct the Owner in the operation of the systems. Instruction shall continue until the Owner is fully satisfied that he understands the operation of his system.

B. Contractor shall obtain Owner’s dated signature that all training has been accomplished and is acceptable to the Owner.

1.09 GUARANTEES AND WARRANTIES

A. The Fire Protection Contractor shall guarantee to the Owner in writing, all equipment and workmanship for a period of one (1) year after the fire protection system has been placed in continuous service and has been accepted by all authorities having jurisdiction.

B. The Fire Protection Contractor shall not be held responsible for improper or negligent maintenance by the Owner after operating and maintenance indoctrination has been given the Owner.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEM EQUIPMENT

A. Where contract documents indicate specific model number or manufacturer; Contractor may substitute identical equipment approved for fire protection use if approved by the Engineer.

2.02 AUTOMATIC SPRINKLERS

A. Install sprinklers from reviewed shop drawings.

B. All sprinklers shall be of similar design and from a single manufacturer.

C. The operating temperature of sprinklers shall be as required by the specific location of installation in accordance with NFPA #13 requirements.

D. Sprinklers shall conform to the following schedule:
   1. Brass upright or pendent may be used in all attic, mechanical, storage or other non-public spaces; or in areas where piping and sprinklers are installed exposed.
   2. White recessed pendent sprinklers with white escutcheons shall be used in all finished areas, offices, bathrooms, corridors, public spaces, etc. Where surface mounted obstructions will not allow for recessed installation, white pendent sprinklers with white two-piece escutcheons may be used to extend sprinklers to a maximum deflector distance as allowed by NFPA or U.L. listing if approved by the Engineer. Recessed installation shall be used whenever possible.
   3. White recessed sidewall sprinklers with white escutcheons may be used in accordance with listing and jurisdictional requirements.
   4. All sprinklers shall be quick-response glass bulb type.
   5. Dry sidewall or dry pendent heads shall be used in all areas subject to freezing (coolers, freezers, vestibules, combustible overhangs, etc.) when the heads are supplied from a heated area wet system or as required when connected to the dry or preaction system.

E. Manufacturers
   1. Tyco
   2. Victaulic
   3. Viking
   4. Reliable

2.03 PIPE AND FITTINGS

A. Interior piping for automatic sprinkler system shall conform to NFPA #13 and as follows.

B. Automatic wet sprinkler system piping with threaded fittings shall be Schedule 40, Dyna Thread or equal black steel with cast iron, malleable iron or ductile iron threaded fittings joined with Teflon tape thread sealing compound or pipe joint compound. Pressure rating of fittings shall be as required for application.

C. Automatic wet sprinkler system piping with grooved fittings shall be Schedule 10, Dyna Flow or equal black steel pipe with painted grooved fittings.

D. Automatic dry sprinkler system and preaction system piping with threaded fittings shall be Schedule 40 galvanized steel with galvanized malleable iron threaded fittings joined with Teflon tape thread sealing compound or pipe joint compound. Pressure rating of fittings shall be as required for application.

E. Automatic dry sprinkler system and preaction system piping with grooved fittings shall be Schedule 10 galvanized steel pipe with painted grooved fittings.

F. Flexible piping drops shall be used to connect piping to sprinklers located in suspended acoustical tile ceilings. Flexible piping drop assemblies shall have stainless steel braided hose coverings.

G. Fittings for plain end pipe shall not be used.

H. All drain and fire department connection piping and fittings down-stream of valves shall be galvanized with galvanized malleable iron threaded fittings or painted grooved fittings.

2.04 HANGERS AND SUPPORTS

A. Space pipe hangers in accord with the requirements of NFPA #13. Construct hangers, hanger rods, inserts and clamps as approved by the same.

B. Manufacturers:
1. Tolco
2. Afcon
3. Erico
4. Speedy Product (Super Screws)
5. Anvil
6. Hilti

2.05 VALVES

A. Gate valves shall be approved indicating type as required by NFPA #13 and NFPA #20. Check valves shall be as required by NFPA #13 and NFPA #20. Inspectors test and drain valves shall be approved brass globe, angle, or ball valves. Locate sprinkler system isolation valves as required complete with a tamper alarm switch.

B. Interior Gate
1. Make: Nibco
2. Sizes: 2½“ through 6”
3. Ends: Flanged
4. Model: F-607-OTS

C. Interior Butterfly
1. Make: Tyco
2. Sizes: 2½" through 6”
3. Ends: Grooved
4. Model: BFV-N
5. Note: Butterfly valves may be used in lieu of OS&Y valves at the Contractor's option for 2½" and larger valves.

D. Ball Valve
1. Make: United Brass
2. Sizes: ¼" through 2"
3. Ends: Threaded
4. Model: 80

E. Check Valve
1. Make: Tyco
2. Sizes: 2½" through 6”
3. Ends: Grooved
4. Model: CV-1F

F. Drain Valve
1. Make: United Brass
2. Sizes: ½" through 2"
3. Ends: Threaded
4. Model: 125SUL

G. Test and Drain Valve
   1. Make: AGF
   2. Sizes: 1" through 2"
   3. Ends: Threaded
   4. Model: 1011, 1000, and 1011T

H. Manufacturers:
   1. Tyco
   2. Victaulic
   3. United Brass
   4. Nibco
   5. AGF Manufacturing

2.06 BACKFLOW PREVENTION DEVICES

A. Install new backflow prevention devices as required by the Water Authority having jurisdiction.

B. Devices shall be UL or FM approved.

C. All reduced pressure backflow prevention devices shall be provided with an air gap drain with splash guard and piped to the exterior or adequate floor drain with galvanized pipe and fittings.

D. Manufacturers:
   1. Febco
   2. Ames
   3. Watts

2.07 FIRE DEPARTMENT CONNECTIONS

A. Furnish and install where approved by the authority having jurisdiction and the Engineer a fire department connection, complete with identification plate, clapper, plugs and chains.

B. Finish shall consist of polished brass.

C. Fire department connections shall be set 2'-6" above grade.

D. Fire department connections for sprinkler system shall be indexed "auto spkr". The indexing shall be "cast in" by the manufacturer. Required indexing shall be permanently installed at the connection.

E. Fire department connection shall be complete with interior independent self-closing clappers, plugs with chains and shall have threads to meet the local fire department requirements.

F. Provide an automatic ball-drip at the low point of the piping between the check valve and the fire department connection.

G. Manufacturers:
   1. Potter Roemer
   2. Croker
   3. Powhatan

2.08 SPECIALTIES

A. Fire Seals
   1. Where piping passes through walls, floors or other building construction which by code requires a fire rating, approved fire rated assemblies shall be used. Proposed protection shall be submitted for approval. Plans will clearly indicate locations of required protection.

B. Escutcheon Plates
   1. Where exposed piping passes through finish work, chrome plated (or other finish acceptable to the Architect) wall plates shall be installed. Split wall plates or escutcheons shall be installed to fit snugly around piping. All wall plates shall be metal.
   2. Solid galvanized wall plates shall be used at both sides of all exterior wall penetrations.

C. Valve Identification

1. All valves within the building shall have permanently marked identification signs provided in accordance with NFPA #13 standards. Signs shall be manufactured and not hand written. Signs shall be hung with galvanized or chrome chain.

D. Spare Head Supply
   1. Furnish and install a supply of extra sprinklers of each type and degree link installed in the project, complete with mountable box. Mount box on wall next to sprinkler riser. Provide wrenches for each type of sprinkler installed in box.

E. Sprinkler Head Guards
   1. Provide head guards on any sprinklers installed within seven feet of the finished floor. Head guards shall be chrome finished and listed for the sprinkler on which they are installed.

2.09 DRY PIPE VALVE

A. Install a low air pressure type dry pipe valve complete with necessary drain valves, pressure switches, check valves, etc., as required by NFPA #13. Assembly shall have a water flow pressure switch and low/high air alarm pressure switch with contacts for wiring to the fire alarm system.

B. Provide and install air compressor, automatic air maintenance device (if required) per NFPA #13 and suitable for low air pressure type dry valve. Air compressors shall include flexible hose connection to system trim.

C. Coordinate air compressor power and connection requirements with the Electrical Contractor.

D. Dry valve shall be the low air pressure type and operate at a pressure range of 13 psi to 18 psi.

E. Manufacturers:
   1. Reliable
   2. Victaulic

2.10 PREACTION VALVE

A. Install a preaction valve complete with necessary drain valves, pressure switches, check valves, etc., as required by NFPA #13. Assembly shall have a water flow pressure switch and low/high air alarm pressure switch with contacts for wiring to the fire alarm system.

B. Preaction valve shall be trimmed for double interlock with electric-electric activation. System to be activated after loss of system pressure (pressure switch) and activation of the detection system. See Fire Alarm system specification detection and releasing system.

C. Provide and install air compressor, automatic air maintenance device (if required) per NFPA #13 for supervisory air. Air compressors shall include flexible hose connection to system trim.

D. Coordinate air compressor power and connection requirements with the Electrical Contractor.

E. Manufacturers:
   1. Reliable
   2. Victaulic

2.11 ELECTRICAL DEVICES

A. All electrical devices shall be coordinated with Fire Alarm system requirements for compatibility of voltages and manufacturer.

B. Flow Switch
   1. Potter VSR-F
   2. Potter VSR-SF

C. Pressure Alarm Switch
   1. Potter PS10-2

D. Low Air Alarm
   1. Potter PS40-2

E. Tamper Switch
   1. Potter OSYSU-2

2. Potter RBVS

F. Audio/Visual Alarm Indicating Appliances
   1. Audio/Visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate either horns, bells, or chimes. The unit shall be complete with a tamper resistant, Pyramidal shaped lens with "Fire" lettering visible from a 180° field of view. Integral Xenon strobe shall provide a minimum light output of 4.5 candela at 24VDC at a 45 flashes per minute rate. Xenon strobes shall provide a 4-wire connection to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox.

2.12 HOSE VALVES

A. Provide 2½" hose valves with 2½" NPT female inlet and 2½" male NSHT outlet complete with 2½" caps and chains.

B. Hose valves shall be installed at the building exterior for testing of the fire pump. Provide identification plate at exterior above the hose valves indexed "Pump Test Connection".

C. Finish of valves and identification plate shall be polished brass.

2.13 FIRE PUMP - GENERAL

A. Fire pump shall be electric motor driven. Fire pump capacity shall be rated at 400 gpm with a rated net pressure of approximately 70 psi. Fire pump shall be rated 30 HP or less. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal in-line fire pump. Pump shall be automatic start and manual stop. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.14 VERTICAL IN-LINE FIRE PUMP

A. Casings shall be of cast iron having a minimum tensile strength of 35,000 P.S.I. Bearing housing supports, and suction and discharge flanges shall be integrally cast with the lower half of the casing. Removal of the upper half of the casing must allow the rotating element to be removed without disconnecting the suction and discharge flanges.

B. Impellers shall be of the enclosed type and shall be of vacuum cast bronze. Impellers shall be dynamically balanced, keyed to the shaft, and held in place with threaded shaft sleeves.

C. The pump shaft shall be made of SAE 1045 Steel or equal, accurately machined to give a true running rotating element. Shaft shall be protected by bronze sleeves which are key locked and threaded so that the sleeves tighten with the rotation of the shaft. A gasket shall seal between the impeller hub and the shaft sleeve to protect the pump shaft.

D. Pump shall be equipped with renewable bronze casing rings so designed that hydraulic pressure will seat them against a shoulder in the pump case around the full periphery of the wearing ring. The wearing rings will be locked by doweling to prevent rotation. The rotating element uses heavy duty grease lubricated ball bearings and shall be equipped with water slingers. Bearing housings shall be so designed to flush lubricant through the bearing.

E. All pumps where the suction pressure is expected to average 40 P.S.I. or below, shall be provided with a lantern ring connected to the pressure side of the pump by a cored passage in the parting flange of the pump. Stuffing boxes shall be equipped with split bronze packing glands designed for easy removal for packing inspection and maintenance.

2.15 ELECTRIC MOTOR DRIVER

A. The design of the power supply to the electric drive fire pumps will comply with Chapter 6 of NFPA #20 and to NFPA #70. The fire pump power supply and fire pump power circuits and feeders will be indicated and detailed on the drawings.

B. Power supply protective devices installed in the power supply circuits and in the fire pump feeder circuits will be designated not to open at the sum of the locked rotor currents (continuous) of the fire pump motor and any other maximum loads on the circuit per NFPA #20.

C. Fire pump feeder circuit conductors will be physically routed outside of the building(s), excluding the electrical switchgear room and the fire pump room. When the fire pump feeder conductors must be routed through the buildings, they will be buried or enclosed by 50 mm (2 inches) of concrete or equivalent fire-rated construction.

D. Designer shall indicate and detail the grounding of the controller per NFPA #20.

E. Controllers and contactors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section. Motor shall conform to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor horsepower shall be of sufficient size so that the nameplate horsepower rating will not be exceed throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

F. Motor shall conform to NEMA standards and have round frame; drip cover; Nema C face; joint Nema and Hydraulic Institute shaft extension.

G. Motor electrical characteristics shall be Nema Design B suitable for full voltage starting: 3-phase; 60-cycle; 208 volts with full load speed as indicated under operating conditions.

H. Motor enclosure shall be open drip proof type with Class B insulation, capable of carrying full load continuously in an ambient temperature of 40° C and shall have a 1.15 service factor.

2.16 CONTROLLERS

A. Control equipment shall meet all requirements of NFPA #20.

B. Control Equipment for Electric Drive

1. The Fire Pump motor control shall be U.L. Listed and/or F.M. Approved, where applicable. It shall be completely assembled, wired and tested by the control manufacturer before shipment from the factory, and shall be labeled "Fire Pump Controller". The controller shall be located as close as practical and within sight of the motor. The controller shall be so located or protected that it will not be injured by water escaping from the pump or connections. The controller shall be of the combined manual and automatic, reduced voltage wye delta type, and shall be complete with:
   a. Disconnect switch - externally operable, quick-break type.
   b. Automatic transfer switch - for connection to building backup electric generator.
   c. Circuit breaker - time delay type with trips in all phases set for 300% of the motor full-load current.
   d. Motor starter - capable of being energized automatically through the pressure switch or manually by means of an externally operable handle.
   e. Pressure switch.
   f. Running period timer - set to keep motor in operation, when started automatically, for a minimum period of one minute for each 10 HP motor rating, but not to exceed 7 minutes.
   g. Pilot lamp - to indicate circuit breaker closed and power available.
   h. Ammeter test link and voltmeter test studs.
   i. Alarm relay - to energize an audible or visible alarm through an independent source of power to indicate circuit breaker open or power failure.
   j. Manual selection station - a two-position station shall be provided on the enclosure marked "Automatic" and "Non-Automatic".
   k. Means shall be provided on the Controller to operate an alarm signal continuously while the pump is running.

2.17 PRESSURE MAINTENANCE PUMP

A. The pressure maintenance pump shall be maximum 2 HP rated. The pump shall operate on 208 volt, 3 phase, 60 hz power.

B. The pump shall have approximately the following characteristics:

1. Volume: 5 gpm

2. Pressure: 70 psi
3. Pump RPM: 3,500 rpm
4. Intake Diameter: 1¼ inch
5. Discharge Diameter: 1¼ inch

C. The pressure maintenance pump shall maintain pressure on system down stream from the pump discharge manifold and compensate for minor system losses. The pump shall take suction from the fire pump intake manifold.

D. An approved indicating gate valve of the outside screw and yoke (OS&Y) or butterfly type shall be provided in the maintenance pump discharge and suction piping.

E. An oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.18 PRESSURE MAINTENANCE PUMP CONTROLLERS

A. The Pressure Maintenance Pump Controller shall be listed by Underwriters Laboratories for industrial control. The controller shall be completely factory wired, assembled and tested prior to shipment. The controller shall be housed in a NEMA Type-2 General purpose - indoors enclosure fabricated from heavy gauge cold rolled steel per the requirements of UL 508.

B. A fusible disconnect switch, with fuses, shall be provided and sized for at least 115 percent of motor full load current. The disconnect switch shall be operated by an externally mounted handle. This handle shall be interlocked with the enclosure door to prevent the opening of the controller door while the switch is in the ON position except by means of a hidden defeater mechanism. The handle shall be capable of being padlocked in the OFF position with provisions for at least three padlocks.

C. The Pressure Maintenance Pump Controller shall include an industrial rated motor starter with properly sized, adjustable, indirectly heated, thermal overloads on all phases. A three position HAND-OFF-AUTO selector switch rated for 600 volts shall be standard. The Pressure Maintenance Pump shall have a solid-state pressure switch, mounted internally such that the pressure switch may be removed independently. The pressure switch shall be mounted using a bulkhead fitting. The Pressure Maintenance Pump Controller shall be equipped with an adjustable solid-state minimum run timer to prevent overheating due to frequent starting. When required, an electrical step down transformer shall be furnished with a minimum capacity of 150VA and shall be fused as per UL 508. The minimum run timer shall be capable of being set for at least two minutes.

D. The controller shall be completely tested at the factory prior to shipment. This test shall verify proper operation of all automatic and manual functions along with a continuity of all dry contacts for remote alarms. The test shall also include a high potential voltage test of all primary power circuits equal to twice the rated voltage plus 1000 volts for one minute.

2.19 PRESSURE SENSING LINES

A. A completely separate pressure sensing line shall be provided for each fire pump and for the pressure maintenance pump. The sensing line shall be arranged in accordance with Figure A-75.2.1 of NFPA #20.

B. All pressure sensing lines to fire pump and pressure maintenance pump controllers shall be copper. Copper pipe shall be seamless and conform to ASTM B-88. All pipe shall be Type L and shall have soldered joints. Solder shall be low lead conforming to ASTM B-32, Grade S65, (95-5).

C. Each sensing line shall be equipped with two restrictive orifice check valves. Restricted orifice check valves shall be brass with the clapper drilled for 3/32 inch (2.4 mm). Restricted orifice check valves shall be mounted in the horizontal position, not less than 5 feet (1.5 m) apart on the sensing line.

D. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass ½ inch (15 mm) globe valves and ¼ inch (8 mm) gauge connection tee arranged per

NFPA #20. One of the test connections shall be equipped with a 0 to 300 psi (0 to 1380 kPa) water oil-filled gauge.

E. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.20 PRESSURE SWITCHES

A. Pressure switches utilized for control of fire pumps shall be UL listed for fire pump service. Each switch shall have independent high and low calibrated adjustments. The pressure sensing elements shall be capable of withstanding a momentary surge pressure of 400 psi without losing accuracy. Suitable provisions shall be made for relieving pressure to the pressure switch to allow testing of the controller operation and pumping unit.

B. The pressure switch shall be of the bourdon tube type with adjustable independent High and Low set points with a range of 10-300 psi. The pressure switch shall be capable of being sealed to prevent unauthorized adjustment. The pressure switch shall be mounted inside the controller cabinet and piped to an external coupling for ease of field connection.

2.21 FIRE PUMP TEST METER

A. The fire pump test meter shall meet all requirements of NFPA #20 for fire pumps. The meter shall be UL listed or FM approved for this application. The meter shall be of the venturi type, iron or steel body, with flanged or grooved ends and shall be rated for pressures up to 275 psi. The flow rate shall read out on a dial graduated in GPM over the full range of the meter. The graduated dial shall be a minimum of 4.5 inches in diameter. The meter shall be accurate over the entire flow range. The meter head loss characteristics shall be compatible with the pumping systems.

B. The meter shall be installed in strict conformance with the manufacturer's instructions and the requirements of NFPA #20. The meter dial shall be located so as to be easily readable from the operating floor without climbing on a ladder or stooping excessively.

C. Flow meter shall be capable of metering any water flow quantities between 50 percent and 150 percent of the rated flow of the pumps.

D. The flow meter shall be arranged in accordance with Figure A.5.19.1.2(b) of NFPA #20. It shall be installed in the pump test header line.

PART 3 EXECUTION

3.01 DESIGN CRITERIA

A. The intent is for the Contractor to provide complete fire protection systems as required. This Contractor shall be responsible for surveying the site, existing construction, and new construction, and providing the complete fire protection system.

B. The contractor shall design the fire protection piping system. Piping shall be installed by the Contractor so as not to interfere with the installation of other piping, ductwork or light fixtures. The fire protection system supplier shall coordinate with all other construction trades prior to installing the fire protection system piping.

C. Piping layout shall not interfere with maintenance clearance requirements for mechanical or electrical equipment. Maintain 36" clearance as necessary for mechanical and electrical equipment. This includes equipment above ceilings (VAV boxes, electric heating coils, fan boxes, etc.).

D. All piping shall be run concealed wherever possible. Where piping is run exposed, special notation shall be evident and conspicuous on the drawings. Exposed piping shall be routed as high as practical and coordinated with the Architect to minimize aesthetic impact on the building. The Contractor shall visit the site and coordinate piping installation with the Architect. A preliminary design concept indicating any exposed piping should be provided to the Architect for review prior to completion of the working drawings. Any exposed piping determined to be a problem by the Architect shall be relocated by the Contractor.

E. Pipe shall not be routed through or above vestibule ceilings wherever possible. Vestibules shall be protected with dry sidewall sprinklers or dry pendent sprinklers from piping above where necessary.

F. The Contractor is responsible for the design of the fire protection system and complying will all applicable Standards and Codes. The fire protection systems design is a Delegated Design submittal. The preparation of all shop drawings and hydraulic calculations shall be accomplished by a Professional Engineer licensed in Wyoming and competent in fire protection. The Professional Engineer responsible for the fire protection system design shall seal and sign the shop drawing and hydraulic calculation submittals.

G. System shall be designed for Light Hazard or Ordinary Hazard Group 2 as identified in NFPA #13. Ordinary Hazard areas include mechanical rooms and storage rooms.

H. Fire pump equipment and fire sprinkler system risers shall be located within the 1-hour rated Fire Pump room. Provide clearance for controller panels as required by NEC.

I. Connect to municipal water system for water supply. See Civil drawings and specifications for fire service suction pipe routing to the fire pump room.

3.02 INSTALLATION

A. Where details of installation are not given, the installation shall be made using manufacturer's recommended practices or at the direction of the Architect or Engineer.

B. Contractor shall complete the fire protection systems ready for operation, in all respects, as soon as possible. When system is complete and ready for continuous operation, activate the system for its intended use.

C. This Contractor shall remove from the building, all rubbish and unused materials due to or connected with this installation.

D. The surface of all piping shall be cleaned and left ready for painting. This includes the removal of any pipe tags or labels from the piping.

3.03 TESTING

A. All testing shall be accomplished in accord with NFPA standards and requirements.

B. This Contractor shall call for inspection and complete Contractor’s Material and Test Certificates signed by the authority having jurisdiction.

C. The entire sprinkler systems shall be hydrostatically tested at not less than 200 psig pressure for a period of not less than two (2) hours or 50 psi above static pressure in excess of 150 psi for two (2) hours with no pressure drop in the system.

D. In addition to the standard hydrostatic test, the automatic dry pipe system and double interlock preaction system shall have an air pressure leakage test at 40 psi conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 1.5 psi for the 24 hours shall be corrected.

E. Fire pump shall be tested in accordance with NFPA #20 acceptance testing requirements.

F. All testing shall be witnessed by a representative of the Engineer or Owner.

G. Where jurisdictional authority's standards are more stringent than the above test, they shall prevail.

H. Furnish copies of Test Certificates with close-out documentation.

END OF SECTION

DIVISION

22

PLUMBING

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. American Society for Testing and Materials:
   1. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   2. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   3. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
   4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   5. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

C. Underwriters Laboratories:
   1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 ACTION SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Qualifications Statement: Submit name and qualifications of insulation applicator and name of supervisor for approval within 30-days after award of Contract.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, having a minimum of 5-years experience and approval of the manufacturer.

B. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

C. Source Limitations: Obtain insulation of each type through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 RIGID GLASS FIBER INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   1. CertainTeed Corporation: certainteed.com.
   2. Johns Manville Corporation: jm.com.
   3. Knauf Insulation: knaufusa.com.

4. Owens Corning Corporation: ocbuildingspec.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum service temperature: 850 degrees F (454 degrees C).
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell: armacell.us.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible. AP Armaflex or approved equal.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Adhesive: Manufacturer's recommended adhesive, compatible with insulation; AP Armaflex 520.

D. Finish: Manufacturer's recommended finish, compatible with insulation; AP Armaflex WB.

E. Fittings: Suppy preformed flexible elastomeric fittings; no field fabricated fittings.

2.03 JACKETS

A. PVC or ABS Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (-18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil (0.25 mm).
      e. Connections: Pressure sensitive color matching vinyl tape.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
   1. Sheild Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Insert Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   3. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   4. Insert location: Between support shield and piping and under the finish jacket.
   5. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   6. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Division 7.

I. Insulate all above grade storm drainage piping, including roof drain sump bodies.

J. Insulate all plumbing vent piping and radon piping within 10 feet of the roof penetration.

3.03 SCHEDULE

A. Domestic Systems:
   1. Domestic Hot Water Supply:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch (____ mm).
   2. Domestic Hot Water Recirculation:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch (25 mm).
   3. Domestic Cold Water Supply:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch (25 mm).

B. Drainage Systems:
   1. Waste and Vent Piping:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch (25 mm).

END OF SECTION

SECTION 22 1010 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, and connections for plumbing piping systems within five feet of the building.
   1. Sanitary sewer.
   2. Domestic water.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. American National Standards Institute:
   1. ANSI Z21.22 - Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

C. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   3. ASME B31.9 - Building Services Piping.

D. American Society for Testing and Materials:
   1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   2. ASTM B32 - Standard Specification for Solder Metal.
   3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   4. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping System.
   5. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   6. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
   7. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

E. American Water Works Association:
   1. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   2. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water.
   3. AWWA C651 - Disinfecting Water Mains.

F. Cast Iron Soil Pipe Institute:
   1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
   2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

G. Manufacturers Standardization Society of the Valve and Fitting Industry:
   1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
   2. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
   3. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.04 ACTION SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
   1. Piping submittals must be clearly identified with intended service and range of sizes indicated.
   2. Valves and other accessory submittals shall be identified to correspond with the piping submittals.

1.05 INFORMATIONAL SUBMITTALS

A. Test Reports: Provide evidence of piping system pressure and leak tests. Include date, section tested, test pressure, and results.

B. Test Reports: Provide evidence of disinfection and bacteriological results of each outlet tested conforming to standards of State and Federal safe drinking water acts.

1.06 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Operation and Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views, etc.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

D. NSF Standard: Comply with NSF 372 - Drinking Water System Components - Lead Content, for materials that will be in contact with potable water.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BELOW GRADE

A. Solid Wall PVC Pipe: ASTM D2665, Schedule 40.
   1. PVC Socket Fittings: ASTM D2665, to fit Sch 40 pipe.
   2. Joints: Solvent welded, with ASTM F565 adhesive primer and ASTM D2564 solvent cement.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

A. Hubless Cast Iron Pipe: ASTM A888 or CISPI 301, service weight.
   1. Fittings: Cast iron ASTM A888 or CISPI 301.
   2. Joints: ASTM C1277 or CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.03 WATER PIPING, BELOW GRADE

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fitings: Ductile or grey iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4-inch diameter rods.

2.04 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88, Type L, Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.05 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 2-1/2" and Over:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   1. Precision Plumbing Products (PPP) Clearflow Dielectric Waterway or equal.

2.06 HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure with U-bolt guides.
   4. Hanger Rods: Mild steel threaded both ends or continuous threaded.
   5. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 2 Inches: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2-1/2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 2 Inches: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2-1/2" and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 Inches (50 mm) to 4 Inches (100 mm): Carbon steel, adjustable, clevis.
   4. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

D. Rigidly mounted domestic piping (where allowed) shall be secured to 12 gauge 1-5/8 inch slotted channel framing with insulated strut clamps.

E. Install steel safety plates on upright stud members to prevent drills and fasteners from penetrating piping.

F. Metal stud insulating pipe clamps shall be used to isolate piping away from steel stud framing.

G. All insulated piping shall be installed with sufficient clearance to accept continuous insulation.

2.07 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries: conbraco.com.
   2. Nibco, Inc: nibco.com.
   3. Milwaukee Valve Company: milwaukeevalve.com.

B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.08 FLOW CONTROLS

A. Manufacturers:
   1. Griswold Controls: griswoldcontrols.com.
   2. IMI TA: imi-hydronic.com.
   3. Flow Design: flowdesign.com.

B. Manual Type: Class 125, lead-free brass or bronze body with union on inlet , temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Autoflow Type: NSF/ANSI 61-G certified and approved with series 300 stainless steel body and o-ring type union with stainless steel internal flow cartridge permanently marked with the flow rate and spring range.

2.09 CHECK VALVES

A. Manufacturers:
   1. Hammond Valve: hammondvalve.com.
   2. Nibco, Inc: nibco.com
   3. Milwaukee Valve Company: milwaukeevalve.com.

B. Swing Type Check Valves:
   1. Up to 2 Inches: MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.
   2. Over 2 Inches: MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

C. Spring Loaded Check Valves: Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.10 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Watts Regulator Company: wattsregulator.com.
   2. Cla-Val Co: cla-val.com.

B. Water Pressure Reducing Valves:
   1. Up to 2 inches: MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
   2. Over 2 inches: MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.11 RELIEF VALVES

A. Manufacturers:
   1. Watts Regulator Company: wattsregulator.com.
   2. Cla-Val Co: cla-val.com.

B. Pressure Relief: AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

C. Temperature and Pressure Relief: AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME (BPV IV) certified and labelled.

2.12 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: armstronginternational.com.
   2. Watts Regulator Company: wattsregulator.com.

B. Size 2 inch (50 mm) and Under:

1. Threaded brass body for 175 psi (1200 kPa) CWP, wye-pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, wye-pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch (100 mm):
1. Class 125, flanged iron body, wye-pattern with 1/16 inch (1.6 mm) stainless steel perforated screen.

2.13 DRAIN VALVES

A. Drain valves shall be ball valves as specified herein or ball valves as part of an integral flange isolator product. All drain valves shall be fitted with American standard hose thread fittings and blind hose caps.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Where modifications to layouts are proposed, the contractor shall include wall cleanouts after every 135-degrees of turn. Floor cleanouts will be considered as a last resort only.

3.03 PLUMBING PIPING INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do not install below grade piping when bedding is wet or frozen.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

E. Install piping to maintain headroom, conserve space, and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with the general contractor.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

K. Install water piping to ASME B31.9.

L. Sleeve all piping passing through partitions, walls, and floors. Install escutcheons on exposed, finished side of penetrations.

M. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Install inserts to extend 1 inch above the finished floor elevation in plumbing chases and mechanical equipment rooms.
3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

N. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9 and MSS SP-89.
2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.

3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Prime coat exposed steel hangers and supports.
8. Provide hangers adjacent to motor driven equipment with vibration isolation.
9. Support cast iron drainage piping at every joint.
10. Provide galvanized hangers, supports, and accessories in locations exterior to the building.

O. Install valves with stems upright or horizontal, not inverted.

P. Plug all open ends of incomplete piping work prevent the entrance of dirt and debris.

Q. Install all pipe mounted temperature control devices (thermowells, valves, flow meters, etc).

3.04 CONNECTIONS

A. Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following: PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.

D. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.05 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, parts of systems, or vertical risers.

D. Provide spring loaded check valves on discharge of water pumps.

E. Provide flow controls in water recirculating systems where indicated.

F. Provide brass or copper nipples at trap arms and dirty arms. Galvanized piping is not permitted.

G. Provide brass nipples at all domestic piping equipment connections. Galvanized piping is not permitted.

H. Exposed accessories beneath sinks and lavatories shall include chrome plated brass p-traps and extensions, quarter-turn angle stops, and braided stainless steel flexible supplies.

I. Exposed piping beneath kitchen prep sinks and three-compartment sinks may be PVC.

3.06 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.08 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.09 FIELD QUALITY CONTROL

A. Testing and Inspection:
   1. General: All new, altered, extended, or replaced plumbing piping systems shall be tested and inspected in accordance with the following requirements and the authority having jurisdiction.
   2. Tests shall be applied to systems in their entirety or in completed sections. Repair any leaks that may occur and repeat the test procedure.
   3. Record and submit test and inspection reports for each system, complete with diagram or description of section tested and any corrective action taken.
   4. Drainage Piping: Sanitary and storm systems shall be filled with water and tested with no less than a 10 foot head of water. The pressure shall be held for not less than 15 minutes.
   5. Water Piping: Supply systems shall be tested under a water pressure not less than 125% of the expected working pressure of the system. The pressure shall be held for not less than 6 hours.
   6. Gas Piping: Gas piping systems shall be installed, examined, inspected, and tested in accordance with requirements of the International Fuel Gas Code and the authority having jurisdiction.

3.10 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1) Maximum hanger spacing: 6 feet.
         2) Hanger rod diameter: 3/8 inches (9 mm).
      b. Pipe size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1) Maximum hanger spacing: 10 feet.
         2) Hanger rod diameter: 3/8 inch (9 mm).
      c. Pipe size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
         1) Maximum hanger spacing: 10 feet.
         2) Hanger rod diameter: 1/2 inch (13 mm).
      d. Pipe size: 4 inches (100 mm) to 6 inches (150 mm):
         1) Maximum hanger spacing: 10 feet.
         2) Hanger rod diameter: 5/8 inch (15 mm).
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 6 feet.

2) Hanger rod diameter: 3/8 inch (9 mm).

END OF SECTION

SECTION 22 1020 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and floor cleanouts.

B. Hydrants and hose bibs.

C. Water hammer arrestors.

D. Temperature limiting valves.

E. Trap primers and seals.

F. Backflow preventers.

G. Access covers.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. American National Standards Institute:
   1. ANSI A117.1 - Accessible and Useable Buildings and Facilities.

C. American Society of Mechanical Engineers:
   1. ASME A112.6.3 - Floor and Trench Drains.

D. American Society of Sanitary Engineering:
   1. ASSE 1010 - Performance Requirements for Water Hammer Arrestors.
   2. ASSE 1011 - Hose Connection Vacuum Breakers.
   3. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
   4. ASSE 1018 - Performance Requirements for Trap Seal Primer Valves.
   5. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type.
   6. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices.
   7. ASSE 1072 - Barrier Type Floor Drain Trap Seal Protection Devices.

E. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

F. Plumbing and Drainage Insitute:
   1. PDI-WH 201 - Water Hammer Arresters

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's standard data sheets describing components including materials, dimensions, relationship to adjacent construction, and attachments. Provide component sizes, rough-in requirements, service sizes, and finishes.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of cleanouts, backflow devices, water hammer arrestors, and other equipment and accessories.

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.06 QUALITY ASSURANCE

A. NSF Standard: Comply with NSF 372 - Drinking Water System Components - Lead Content, for materials that will be in contact with potable water.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 ROOF AND FLOOR DRAINS

A. Manufacturers:
   1. Jay R Smith Manufacturing Company: jayrsmith.com.
   2. Josam Company: josam.com.
   3. Zurn Industries: zurn.com.

B. General:
   1. Precise locations of drains shall be detailed by the architectural drawings. Where drain locations conflict with structural elements, confirm locations with architect prior to rough-in.
   2. Furnish flashing flange for all structural type membrane floors.

C. Floor Drain:
   1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

D. Floor Sink:
   1. ASME A112.6.3; 12 inch square cast iron flanged receptor with seepage holes, acid resistant coated interior, and loose set acid resistant coated cast iron grate, body with dome strainer. Provide 6 inch depth unless noted otherwise.

2.02 WALL AND FLOOR CLEANOUTS

A. Manufacturers:
   1. Jay R Smith Manufacturing Company: jayrsmith.com.
   2. Josam Company: josam.com.
   3. Zurn Industries: zurn.com.

B. General:
   1. Furnish and install cleanouts where indicated on the drawings and at all bends, angles, upper terminals, and not over 50 feet apart.
   2. All cleanouts to have bronze countersunk rectangular slotted plugs lubricated with non-hardening thread lubricant.
   3. Flush-with-floor cleanout tops shall have non-skid covers.
   4. Furnish flashing flange for all structural type membrane floors.

C. Interior Finished Floors:
   1. Cast iron adjustable floor level cleanout assembly with round nickel bronze top.

D. Exterior Unfinished Floors:
   1. Cast iron adjustable floor level cleanout assembly with round heavy duty cast iron top.

E. Interior Finished Walls:
   1. Cast iron ferrule with lead seal plug, round stainless steel cover with center screw.

2.03 HYDRANTS AND HOSE BIBS

A. Manufacturers:
   1. Jay R Smith Manufacturing Company: jayrsmith.com.
   2. Wooford Manufacturing Company: woodfordmfg.com
   3. Zurn Industries: zurn.com.

B. Wall Hydrants:
   1. ASSE 1019; freeze resistant, self-draining type with polished bronze wall plate, hose thread spout, removable key, and integral vacuum breaker.

C. Hose Bibs:
   1. ASSE 1011; Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, with handwheel, and integral vacuum breaker.

2.04 REFRIGERATOR VALVE AND RECESSED BOX

A. Manufacturers:
   1. IPS Corporation: ipscorporation.com
   2. Oatay: oatay.com

B. Description: Powder-coated metal preformed rough-in box with brass valves and lever handle, slip in finishing cover.

2.05 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R Smith Manufacturing Company: jayrsmith.com.
   2. Watts Regulator Company: wattsregulator.com.
   3. Zurn Industries: zurn.com.

B. Water Hammer Arrestors:
   1. ASSE 1010; Copper construction, lead-free, piston type sized in accordance with PDI-WH 201, pre-charged suitable for operation in temperature range 34 to 250 degrees F (1 to 120 degrees C) and maximum 150 psi (1000 kPa) working pressure.
   2. Install in an upright position at all quick closing valves, solenoids, and plumbing fixtures. Locate and size in accordance with PDI-WH 201.

2.06 TEMPERATURE LIMITING VALVES

A. Manufacturers:
   1. Powers: powerscontrols.com

B. Temperature Limiting Valves:
   1. ASSE 1070; constructed of solid brass, with internal components of corrosion resistant material, integral checks to prevent cross flow, and inlet screens to filter debris.
   2. The valve must control each performance standard down to 0.5 gpm. Control temperature must be adjustable between 80 to 100 degrees F with a locking nut to prevent unauthorized or accidental adjustment.
   3. Install at all sinks and lavatories subject to public use. Do not install at kitchen sinks or mop basins.

2.07 TRAP SEALS

A. Manufacturers:
   1. ProVent Systems: trapguard.com.
   2. Jay R Smith Manufacturing Company: jayrsmith.com.

B. Trap Seals:
   1. ASSE 1072; elastomeric, normally closed, floor drain evaporation resistant sealing system.
   2. Trap seals may be installed in lieu of trap primers with approval of the authority having jurisdiction.
   3. Trap seals may not be used in kitchens or other areas subject to wax or grease.

2.08 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Wilkins Valve Company: zurn.com.
   2. Watts Regulator Company: www.wattsregulator.com.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two service valves, strainer, test cocks, and supplied with an air gap fitting.

2.09 ACCESS COVERS

A. Manufacturers:

1. Acudor Poducts: acudor.com.
2. Elmdor/Stoneman Manufacturing: elmdorstoneman.com.

B. General:
1. Furnish and install access covers for all concealed valves, cleanouts, trap primers, water hammer arrestors, and other concealed equipment not accessible from utility spaces.
2. All doors to be minimum 16 gage construction. All doors to be removable from frames. All hinges shall be concealed type; exposed piano hinges are not permitted.
3. All doors and covers located in rated construction shall be supplied with a fire rating equal to or greater than the rated assembly.

C. Schedule:
1. Masonry surfaces - Prime coated steel with cylinder lock.
2. Painted surfaces - Prime coated steel with cylinder lock.
3. Tiled surfaces - Satin finish stainless steel with cylinder lock.
4. Fire rated walls - Prime coated steel with self-latching bolt and flush key.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install all plumbing specialties in a readily accessible location. Install access doors where required.

C. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding of drainage system.

D. Encase exterior cleanouts in concrete flush with grade. Size to be 24" by 24" by 6" thick minimum.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

G. Pipe relief from backflow preventer to nearest drain.

H. Install water hammer arrestors complete with accessible isolation valve on cold water supply piping to all quick closing valves, solenoids, and other locations indicated. Size and install in accordance with the mfgr's instructions.

I. Install temperature limiting valves at all single or multiple point-of-use lavatories and sinks serving public use fixtures or where required by the local authority having jurisdiction. Do not install at kitchen prep sinks.

J. Protect drains and other specialties during construction period to avoid clogging with dirt or debris, and to prevent damage from traffic or other construction work. Plug all open ends of incomplete piping at the end of each day's work.

K. In lieu of trap primer valves and with permission of the local authority having jurisdiction, install listed and approved trap primer seals at each floor drain and floor sink. Do not install in kitchens or where waxed floor surfaces will be installed.

L. Where not indicated by architectural drawings:
1. Set floor drains for individual restrooms, custodial closets, and other small areas depressed into slabs 1/4-inch.
2. Set floor drains for gang restrooms and other larger areas depressed into slabs 1/2-inch.
3. Set floor sinks such that grate is flush with the floor level.
4. Install floor drains with the slab installation.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Residential electric.

B. In-line circulator pumps.

C. Pressure booster systems.

D. Sump pumps.

E. Sewage ejectors.

F. Submersible sump pumps.

1.02 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NFPA 70 - National Electrical Code.

D. UL 778 - Standard for Motor-Operated Water Pumps.

E. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters, in-line circulator, and sump pumps.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:
   1. A.O. Smith Water Products Co: www.hotwater.com.
   2. Bradford White: www.bradfordwhite.com.

B. Residential Electric:
   1. Type: Automatic, electric, vertical storage.
   2. Tank: Glass lined welded steel, thermally insulated with one inch (25 mm) thick Non-CFC foam; encased in corrosion-resistant steel jacket; baked-on enamel finish.
   3. Controls: Automatic water thermostat with temperature range from 120 to 170 degrees F (49 to 77 degrees C), flanged or screw-in nichrome elements, enclosed controls and electrical junction box. Wire double element units so elements do not operate simultaneously.
   4. Accessories:

a. Water Connections: Factory installed true dielectric fitting.
b. Dip Tube: Brass.
c. Drain valve.
d. Anode: Magnesium.
e. Temperature and Pressure Relief Valve: ASME labeled.

2.02 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com.
2. Bell & Gossett, a xylem brand: www.bellgossett.com.
3. Taco: www.tacocomfort.com_____.

B. Casing: Bronze, rated for 125 psig (860 kPa) working pressure, with stainless steel rotor assembly.

C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

D. Seal: Carbon rotating against a stationary ceramic seat.

E. Drive: Flexible coupling.

2.03 PRESSURE BOOSTER SYSTEMS

A. Manufacturers:
1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com.
2. Grundfos: www.grunfos.com.

B. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and copper piping, with control panel assembled on fabricated steel base with structural steel framework.

C. Controls and Instruments: Locate in NEMA 250 Type 1 general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, magnetic starters with three overloads, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gages.

D. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.

E. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.

F. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.

G. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.

H. Pump Switch: Permit manual or automatic operation.

I. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge.

J. Time Clock for Automatic Day-Night Changeover:
1. Day cycle: System shall operate continuously with pressure to fixtures maintained by pressure reducing valves.
2. Night Cycle: Pump shall operate intermittently on pressure switch located near pressure tank operating pump for pre-determined adjustable time period.

2.04 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:
1. Goulds Water Technology, a xylem brand; _____: www.goulds.com.
2. Liberty Pumps:www.libertypumps.com.

B. Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body and oil filled motor chamber.

D. Impeller: Cast iron; open non-clog, stainless steel shaft.

E. Bearings: Ball bearings.

F. Sump: Fiberglass basin with steel cover plate; ____ inches (____ mm) diameter, ____ inches (____ mm) deep.

G. Accessories: Oil resistant 6 foot (2 m) cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

I. Controls: Integral diaphragm type level controls with separate liquid level control high level alarm.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Pumps:

1. Ensure shaft length allows sump pumps to be located minimum 24 inches (600 mm) below lowest invert into sump pit and minimum 6 inches (150 mm) clearance from bottom of sump pit.
2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
3. Provide electrical interlocking from cooling condensate pump safety switch to associated HVAC unit(s) furnished under other Sections.

END OF SECTION

SECTION 22 4200 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Mop basins.

F. Water coolers.

G. Emergency fixtures.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. American National Standards Institute:
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ANSI Z358.1 - Standard for Emergency Eyewash and Shower Equipment.

C. American Society of Mechanical Engineers:
   1. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
   2. ASME A112.18.1 - Plumbing Supply Fittings.
   3. ASME A112.19.2 - Ceramic Plumbing Fixtures.
   4. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.
   5. ASME A112.19.5 – Flush Valves and Spuds for Water Closets, Urinals, and Tanks

D. American Society of Sanitary Engineering:
   1. ASSE 1016 – Performance Requirements for Individual Automatic Compensating Valves.
   2. ASSE 1037 - Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures
   3. ASSE 1070 – Performance Requirements for Water Temperature Limiting Devices.
   4. ASSE 1071 – Performance Requirements for Temperature Actuated Mixing Valves.

E. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include selected fixture and trim, fittings, accessories, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
      a. Each fixture and all related accessory trim shall be submitted grouped together and clearly identified to correspond with the individually scheduled mark.
      b. Submittals with cut sheets referencing multiple fixtures and/or not grouped according to the scheduled mark will be returned without review.
      c. Color to be manufacturer's standard commercial bright white unless noted otherwise.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fixtures, faucets, flush valves, and electronic sensors to include in operation and maintenance manuals. Include fixture trim exploded view and replacement parts lists.

B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each source through one source from a single manufacturer, unless specifically indicated otherwise.

B. Products Requiring Electrical Connection: Listed and labeled as defined in NFPA 70, by Underwriters Laboratories, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ANSI A117 and Americans with Disabilities Act regarding plumbing fixture for people with disabilities.

D. NSF Standard: Comply with NSF 372 - Drinking Water System Components - Lead Content, for faucet materials that will be in contact with potable water.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

C. All fixtures shall be protected from damage to the date of final acceptance ot the project. Any fixture or component found defective or damaged shall be replaced, not repaired.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All plumbing fixtures and trim shall be of one make, except where noted otherwise. All trim shall consist of chrome-plated brass, including faucet spouts and handles unless otherwise specified.

B. All plumbing fixtures shall be set level and plumb, spaced in accordance with the architectural drawings, and securely installed so as to be absolutely rigid. Provide sealant at all mounting surfaces.

C. All hot and cold water connections shall be provided with chrome plated annealed supplies and angle stops. All wall penetrations shall be finished with chrome-plated escutcheons for complete coverage.

D. All wall mounted fixtures shall be installed with floor mounted, concealed arm type carrier supports, for the wall depths shown on the architectural drawings.

2.02 MANUFACTURERS

A. Subject to compliance with requirements, provide basis of design products indicated on the drawings or comparable products by one of the following:

B. Vitreous China Fixtures:
   1. American Standard: www.americanstandard-us.com.
   2. Kohler Company: www.kohler.com.

C. Stainless Steel Fixtures:
   1. Elkay Manufacturing Company: www.elkayusa.com.
   2. Just Manufacturing: www.justsinks.com.

D. Lavatory and Sink Faucets:
   1. Delta Faucet Company: www.deltafaucets.com.

E. Flush Valves:
   1. Sloan Valve Company: www.sloanvalve.com

F. Drinking Fountains:

1. Elkay Manufacturing Company: www.elkayusa.com.

G. Mop Service Basins:
1. Fiat Products: www.fiatproducts.com.

H. Emergency Fixtures:
1. Haws Corporation: www.hawsco.com.

2.03 WATER CLOSETS

A. Water Closets: ASME A112.19.2; vitreous china, floor-mounted or wall-hung with elongated rim.
1. Flush Volume: 1.6 gallon, maximum.
2. Flush Style: Siphon jet flush action.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Supply Size: 1-inch.
6. Outlet Size: 3-inch.

B. Flush Valves: ASSE 1037, diaphragm type, with integral check stops and backflow device.
1. Sensor Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

C. Seats: Solid plastic, elongated rim, open front, extended back, self-sustaining hinge, brass bolts, without cover, white in color.

D. Carriers: ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 URINALS

A. Urinals: ASME A112.19.2; vitreous china, wall hung with side shields and integral trap.
1. Flush Volume: 1.0 gallon, maximum.
2. Flush Style: Washout flush action.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Supply Size: 3/4-inch.
6. Outlet Size: 2-inch.

B. Flush Valves: ASSE 1037, diaphragm type, with integral check stops and backflow device.
1. Sensor Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

C. Carriers: ASME A112.6.1M; type I urinal carrier, cast iron and steel frame, with fixture support plates and coupling with seal for wall-mounting urinal-type fixture. Include steel uprights with feet.

2.05 LAVATORIES

A. Wall-Mounted: ASME A112.19.2; vitreous china, rectangular basin with splash lip, ledge back, front overflow, and soap depression.

B. Supply Faucet: ASME A112.18.1; brass body, chrome plated supply fitting with indexed handles, open grid strainer, and water economy aerator with maximum flow of 2.2-gal per minute.

C. Accessories:
1. Chrome-plated 17-gauge brass p-trap and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver or loose-key quarter-turn stops.
4. ASSE 1070 solid brass temperature limiting valves.
5. Chrome-plated rigid or flexible supplies with escutcheons.
6. ADA compliant protective pipe covers where indicated.

2.06 SINKS

A. Wall-Mounted:

B. Supply Faucet: ASME A112.18.1; brass body, chrome plated supply fitting with indexed handles, open grid strainer, and water economy aerator with maximum flow of 2.2-gal per minute.

C. Accessories:
   1. Chrome plated 17-gauge brass p-trap and arm with escutcheon.
   2. Basket strainer or offset waste with perforated open strainer.
   3. Screwdriver or loose-key quarter-turn stops.
   4. ASSE 1070 solid brass temperature limiting valves.
   5. Chrome-plated rigid or flexible supplies with escutcheons.
   6. ADA compliant protective pipe covers where indicated.

2.07 MOP SERVICE BASINS

A. Mop Basin: White molded stone, floor mounted, with one inch wide shoulders, stainless steel strainer.

B. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver check stops with covering caps and adjustable threaded wall flanges.

C. Accessories:
   1. Plain end reinforced plastic hose, 1/2-inch diameter, 5-ft length.
   2. Hose clamp hanger.
   3. Mop hanger.

2.08 DRINKING FOUNTAINS

A. Water Cooler: Electric, mechanically refrigerated; surface handicapped mounted; stainless steel top, stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push bar controls, touchless bottle filling station, with integral air cooled condenser and stainless steel grille.
   1. Capacity: 8-gal per minute of 50-deg F water with inlet at 80-deg F and room temperature of 90-deg F, when tested in accordance with ASHRAE Std 18.
   2. Electrical: 115 V, 60 Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector.
   3. Bottle Filling Station: Sanitary, touchless activation with auto 20-sec shut-off timer, 1.1-gal per minute laminar flow, where indicated.

2.09 EMERGENCY FIXTURES

A. Emergency Eye and Face Wash: Self-cleaning, non-clogging with quick opening, full-flow valves, ABS receptor, twin eye wash heads, copper alloy control valve and fittings, complying with ANSI Z358.1. Wall-mounted or free-standing as indicated on the drawings.

B. Water Tempering: ASSE 1071 thermostatic mixing valve, solid brass body with corrosion resistant and lead-free internal components, designed to supply tepid water with internal cold-water bypass to continue cold-water flow in case of unit failure.

2.10 PROTECTIVE PIPE COVERS

A. Manufactured plastic wraps for covering plumbing fixture hot and cold water supplies and trap and drain piping. Comply with ADA requirements.
   1. Single or multi-piece design, non-absorbent, uv-inhibited, anti-microbial surface with white finish and tamper-resistant fastening system.
   2. Tested in compliance with ASTM E84, with a 25 flame spread index and 450 smoke developed index.

2.11 FITTINGS FOR PLUMBING FIXTURES

A. Refer to plumbing fixtures schedules on the drawings for specific accessories and fittings. Other miscellaneous fittings include:

1. Supply Stops: Chrome-plated brass, angle or straight, quarter-turn ball-type or compression valve, same size as indicated supply.
2. Supply Piping: Chrome-plated-brass pipe, or chrome-plated copper tube, or braided stainless steel flexible connectors matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
3. Traps: Tubular brass with 17-gauge wall thickness, slip-joint inlet, wall-flange, escutcheons, and size as indicated on the drawings. Use chrome-plated tube for exposed applications.
4. Continuous Waste: Tubular brass, minimum 17-gauge wall thickness, with slip joint inlet. Use chrome-plated tube for exposed applications. Size to match equipment.
5. Indirect Waste: PVC or copper, size to match fixture.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, and casework for suitable conditions where fixtures are to be installed.

B. Examine rough-in for sanitary drainage and vent piping systems and supports to verify actual sizes and locations and types of supports, before fixture installation.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks before rough-in and installation.

D. Where applicable, verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated on the drawings.

3.03 INSTALLATION

A. Install fixtures level and plumb. Assemble fixtures, trim, fittings, and other components according to manufacturer's written instructions and rough-in drawings.

B. Install accessible, wall-mounted fixtures at mounting height for handicapped/elderly in accordance with ANSI A117.1.

C. Install lever-operated water closets and flush valves for accessible water closets with handle mounted on open side of water closet.

D. Attach supply piping to supports or substrate within pipe spaces behind fixtures so as to be rigid and not subject to push or pull movement.

E. Install supports, affixed to building substrate, for wall-mounted fixtures.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

F. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.

G. Install trap and waste piping on drain outlet of fixtures that are indicated to be directly connected to drainage system.

H. Install indirect waste piping on drain outlet of fixtures that are indicated to be indirectly connected to drainage system.

I. Install escutcheons at piping penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern if required to conceal protruding fittings.

J. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

K. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks.

L. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

M. Double-nut fixture studs at the face plates on all wall-mounted water closet carrier supports.

3.04 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Adjust temperature limiting devices to the Owner's preference. Adjust any rotational limit stops on shower valves to a safe temperature.

C. Operate and adjust disposers and controls. Replace damaged and malfunctioning units.

D. Adjust water pressure for intended water flow rate to fixtures without splashing, noise, or overflow.

E. Replace washers and seals of leaking and dripping faucets and stops.

F. Install fresh batteries in sensor-operated equipment.

3.05 CLEANING

A. Clean fixtures, faucets, and fittings with manufacturer's recommended cleaning methods and materials.

B. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

C. Remove sediment and debris from traps and drains.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by the Owner.

C. Repair or replace damaged products prior to the date of substantial completion.

3.07 SCHEDULES

A. Fixtures and Faucets: See fixture schedules on the drawings for Basis of Design.

B. Fixture Heights: Install fixtures to heights above finished floor as indicated on the architectural drawings.

END OF SECTION

DIVISION

23

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 2310 - REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refrigerant piping and fittings.

B. Refrigerant piping specialties.

C. Refrigerant.

D. Valves.

E. Flexible connections.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. Air-Conditioning, Heating, and Refrigeration Institute:
   1. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers.
   2. AHRI 710 - Performance Rating of Liquid-Line Driers.
   3. AHRI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Driers.
   4. AHRI 750 - Standard for Thermostatic Refrigerant Expansion Valves.
   5. AHRI 760 - Standard for Performance Rating of Solenoid Valves for Use With Volatile Refrigerants.

C. American Society of Heating Refrigeration and Air-Conditioning Engineers:
   1. ASHRAE Std 15 - Safety Standard for Refrigeration Systems.

D. American Society of Mechanical Engineers:
   1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.
   3. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
   4. ASME B31.9 - Building Services Piping.

E. American Society for Testing and Materials:
   1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   2. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

F. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

G. Manufacturers Standardization Society of the Valve and Fitting Industry:
   1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.04 ACTION SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

B. Operation and Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

B. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Valves:
   1. Use service valves on suction and discharge of compressors and fan coils.

2.02 REFRIGERANT PIPING

A. Copper Tube: ASTM B280, type ACR, H58 hard drawn .
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Brazed, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 1-3/8 inch OD: ASTM B88, ACR Type K (A), annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.
   3. Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Supports: Slotted channel framing with insulated strut clamps.
   5. Hanger Rods: Mild steel threaded both ends or continuous threaded.
   6. Vertical Support: Steel riser clamp.

2.03 PIPING SPECIALTIES

A. EXPANSION VALVES
   1. For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system. Size valves to provide full rated capacity of cooling coil served. Coordinate valve selection with evaporator and condenser units.

B. FILTER/DRYER
   1. On liquid lines 3/4 inch and larger, filter/dryer shall be replaceable core type with non-ferrous casing and schrader type valve. On lines smaller than 3/4 inch, filter/dryer shall be a sealed type using sweat copper fittings. Size shall be full line size.

C. SIGHT GLASS

1. Combination moisture and liquid indicator with cap. Sight glass shall be line size, of solid copper or brass. Coated steel is not allowed.

D. SERVICE VALVES
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.

E. FLEXIBLE CONNECTIONS
   1. Connectors shall be for refrigerant service with bronze seamless corrugated hose and bronze braiding.

2.04 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

B. All refrigerant piping specialties shall be designed for use with and have materials compatible with R-410a refrigerant as required. Pressure rating for all accessories shall be 500 psi minimum.

2.05 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com.
   2. Henry Technologies: www.henrytech.com.
   3. Flomatic Valves: www.flomatic.com.

B. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 300 degrees F (149 degrees C).

C. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi (3450 kPa).

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Conform to ASME B31.9 for installation of piping system.

B. Install refrigeration specialties in accordance with manufacturer's instructions.

C. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and avoid interference with use of space.

E. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40-percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Flood piping system with nitrogen when brazing.

J. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

K. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

L. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

M. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

N. Provide service valves on each liquid and suction line connection where valves are not supplied as integral to the equipment.

O. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

P. Fully charge completed system with refrigerant after testing.

Q. Where pipe run lengths exceed 50 feet or the evaporator is located more than 8 feet above the condenser, provide piping systems with liquid line solenoid valves, inverted traps at coil connections, and additional refrigerant oil in accordance with the manufacturer's instructions.

R. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

S. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

T. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow and at equipment. Do not support piping from equipment.
   5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi (1380 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psi (1380 kPa) using halide torch. Test to no leakage.

3.04 SYSTEM CHARGING

A. Install core in filter dryers after leak test but before evacuation.

B. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

C. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

D. Charge system with a new filter-dryer core in charging line

3.05 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Verify that compressor oil level is correct.
   2. Open compressor suction and discharge valves.
   3. Open refrigerant valves except bypass valves that are used for other purposes.
   4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

3.06 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch (13 mm), 5/8 inch (16 mm), and 7/8 inch (22 mm) OD: Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6.3 mm).
   2. 1-1/8 inch (29 mm) OD: Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6.3 mm).
   3. 1-3/8 inch (35 mm) OD: Maximum span, 7 feet (2100 mm); minimum rod size, 3/8 inch (9.5 mm).
   4. 1-5/8 inch (41 mm) OD: Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

END OF SECTION

SECTION 23 3110 - HVAC DUCTWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rectangular ducts and fittings.

B. Round ducts and fittings.

C. Underground preinsulated duct.

D. Phenolic pre-insulated duct system.

E. Sheet metal materials.

F. Internal duct liner.

G. Sealants and gaskets.

H. Hangers and supports.

I. Duct leakage testing.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. American Society for Testing and Materials:
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength.
   4. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
   5. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
   6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   7. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.

D. North American Insulation Manufacturers Association:
   1. NAIMA AH124 - Fibrous Glass Duct Liner Standard.

E. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
   2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
   3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. Sheet Metal and Air-Conditioning Contractors National Association:
   1. SMACNA (DCS) - HVAC Duct Construction Standards – Metal and Flexible.
   2. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines.
   3. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

G. Underwriters Laboratories:

1. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.
2. UL 723 – Standard for Surface Burning Characteristics of Building Materials.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.
   3. Underground ducts.
   4. Phenolic pre-insulated duct system.

B. 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.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA (DCS) and performance and design criteria indicated in this section.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA (DCS) and ASCE/SEI 7.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure ductwork is undamaged and complies with the specification.

B. Protect ductwork by storing in durable, water-proof, above ground packaging. Do not store material on grade.

C. Protect ductwork from moisture, dirt, dust, construction debris, and foreign materials. Where end caps or packaging is provided, take precaution so protection remains in place and free from damage.

D. Ductwork shall be kept sealed and cleaned prior to and after installation. All ductwork not kept clean, in the opinion of the architect, will be replaced at no additional cost to the project.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All ductwork shall be constructed to be free from vibration, chatter, objectionable noise or pulsations, and leakage under specified operation conditions.

B. Use material, weight, thickness, construction, support, and installation methods as outlined in the above listed SMACNA publications.

C. Duct pressure classification and sealing requirements shall be as specified herein and not as recommended in SMACNA publications.

D. Duct sizes indicated on the drawings are net inside dimensions. Where sizes are not indicated, the duct segment size shall be equal to the largest duct segment to which it is attached.

E. Duct sizes indicated on the drawings are net inside dimensions. Where sizes are not indicated, the duct segment size shall be equal to the largest duct segment to which it is attached. Transition to a smaller size shall occur on the side of the fitting where the smaller size is connected.

F. Seal Class Requirements: All ductwork, including low pressure ductwork, shall be sealed to SMACNA Seal Class A with all joints, seams, and penetrations sealed.

G. Leakage Class Requirements: All rectangular ductwork shall be SMACNA Leakage Class 6, and all round ductwork shall be SMACNA Leakage Class 3.

2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA (DCS) for materials involved, duct-support intervals, and other provisions, based on indicated static-pressure class, and sealing requirements stated herein.

B. Longitudinal Seams: Select seam types and fabricate according to SMACNA (DCS), Figure 2-2, "Rectangular Duct/Longitudinal Seams."
   1. Longitudinal seams shall be flat crimped Pittsburgh lock (SMACNA Type L1) with specified sealant applied over seams.

C. Transverse Joints: Select joint types and fabricate according to SMACNA (DCS), Figure 2-1, "Rectangular Duct/Transverse Joints."
   1. Transverse joints in ducts 24-inches and under on the longest side may be slip and drive type or flanged.
   2. Transverse joints in ducts exposed to view and concealed ducts larger than 24-inches shall be flanged.

D. Branch Connections: Comply with SMACNA (DCS), Figure 4-6, "Branch Connections."
   1. Rectangular Main to Rectangular Branch: 45-degree entry.
   2. Rectangular Main to Round Branch: Conical spin-in or high-performance type.

E. Elbows: Comply with SMACNA (DCS), Figure 4-2, "Rectangular Elbows."
   1. Use radius throat, radius heel elbows (SMACNA Type RE 1) with a minimum centerline radius to width ratio of one and one half times.
   2. Where 1.5 radius elbows will not fit, use short radius elbows (SMACNA Type RE 3) with a minimum centerline radius to width ratio of one times and two radius proportional splitter vanes installed within.
   3. Where radius elbows will not fit or where shown on the drawings, use rectangular mitered elbows (SMACNA Type RE 2) with vanes complying with SMACNA (DCS), Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

F. Transitions, Offsets, and Other Duct Construction: Select types and fabricate according to SMACNA (DCS), Chapter 4, "Fittings and Other Construction."

2.03 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA (DCS), Chapter 3, "Round, Oval, and Flexible Duct," for materials involved, duct-support intervals, and other provisions, based on indicated static-pressure class, and sealing requirements stated herein.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA (DCS), Figure 3-2, "Round Duct Longitudinal Seams."
   1. All exposed round duct shall be spiral lock-seam (SMACNA Type RL1) with gored elbows. No snap-lock or longitudinal seams are permitted.

D. Transverse Joints: Select joint types and fabricate according to SMACNA (DCS), Figure 3-1, "Round Duct Transverse Joints,"
   1. Use beaded sleeve joints (SMACNA Type RT1) with minimum 2-inch insertion length, or flanged joints (SMACNA Type RT2 or RT2A).
   2. Transverse joints in concealed ducts 24-inches and larger in diameter and exposed ducts 12-inches and larger in diameter shall be flanged.

E. Tees and Laterals: Select types and fabricate according to SMACNA (DCS), Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees."
   1. Use 45-degree lateral or combination taps. Where velocities are less than 1000 feet per minute, conical tees may also be used.
   2. Saddle taps are permitted in existing ducts only.

F. Elbows: Comply with SMACNA (DCS), Figure 3-4, "Round Duct Elbows."
   1. Use radius elbows with a minimum centerline radius to diameter ratio of one and one half times. Where 1.5 radius elbows will not fit and velocity is 1200 feet per minute or lower, use 1.0 radius elbows.
   2. Round elbows shall be welded, segmented type. Elbows 10-inches and smaller may be stamped. Adjustable elbows are not permitted.

2.04 SHEET METAL MATERIALS

A. General Requirements: Comply with SMACNA (DCS) 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.
   1. Galvanized Coating Designation: G90.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A1008, with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: ASTM A36, steel plates, shapes, and bars; black and galvanized.

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.

2.05 DUCT LINER

A. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   1. CertainTeed Corporation: certainteed.com.
   2. Johns Manville Corporation: jm.com.
   3. Knauf Insulation: knaufusa.com.
   4. Owens Corning Corporation: ocbuildingspec.com.

B. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

C. Maximum Thermal Conductivity:
   1. Type I, Flexible: 0.27 at 75 deg F mean temperature.
   2. Type II, Rigid: 0.23 at 75 deg F mean temperature.

D. Water Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

E. 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.

2.06 SEALANT AND GASKETS

A. General Requirements: Surface-burning characteristics for sealants and gaskets shall have a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723.

B. Joint and Seam Sealant: Water-based, indoor or outdoor service, water resistant, mold and mildew resistant, maximum 75 g/L VOC content, compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.07 HANGERS AND SUPPORTS

A. Strap and Rod Sizes: Comply with SMACNA (DCS), Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Galvanized-steel shapes and plates for galvanized steel ducts.

G. Channel Support System: Shop or field fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.08 UNDERGROUND DUCT SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide basis of design products indicated on the drawings or comparable products by one of the following:
   1. BlueDuct by AQC Industries: www.aqcind.com

B. Complete duct system (including: plenums, round duct, run-outs, diffuser boots, etc.) must be from one manufacturer and be of the same material, construction and connection method throughout. Field made duct components are NOT acceptable.

C. Include the complete underground duct system including plenums and diffuser boots.

D. Unless otherwise noted, all duct and fittings shall be constructed per SMACNA's Duct Construction Standards (+10 w.g.).

E. Provide elbows, duct, diffusers, plenum, clamp & gasket, boots, saddle registers, caulk, water gauge test and adapters as required by drawings for underground installation.

F. Ductwork shall be HDPE, closed cell plastic material that is recyclable, does not emit volatile organic compounds, and conforms to ASTM-D2412. Ductwork shall be resistant to mildew, mold (UL 181B), and radon gas (BSS 7239-88). Ductwork shall not rust or crack under external stress or strain. Ductwork shall have R-10 thermal insulation value without the use of external insulation.

G. All joints shall be gasket and sealed. Clamps and gaskets shall be used on ductwork without flanges. Clamps shall be polyethylene with 410 stainless steel plates and stainless steel screws. Gaskets shall comprise of 1/4" thick butyl rubber sealant tape with silver polyester facing that is water and UV resistant and shall not stain. Gaskets shall comply with ASTM-E84 for flame and smoke spread.

H. Flanged joints and duct branches shall use a co-polymer adhesive caulking sealant that is water and UV resistant. Flanges shall be connected with stainless steel bolts.

I. Assembled ductwork shall be able to maintain +/- 10" static pressure with no leakage.

J. Assembled ductwork shall be approved for installations 48" below flood plain elevation without water intrusion.

K. Duct system installed by manufacture trained installer will be an air and water tight system.

L. Fiberglass style ductwork or PVC coated galvanized steel ductwork shall NOT be acceptable.

M. Duct system performance shall exceed SMACNA's Leakage Class 3 requirements at the system design static pressure.

N. Duct system shall carry a 10 year warranty. 10 year warranty is contingent on the installing contractor's field installation crew being installation certified by AQC.

2.09 INDOOR PHENOLIC DUCT SYSTEM

A. Maybe used in place of ductwork in the system.

B. Ductwork System materials, including the panel, adhesive, tape, sealant, flanges and gasket to be certified by Underwriters' Laboratory standard as a Class 1 air duct (UL 181)

C. The panel shall be manufactured of CFC-free phenolic foam thermo-bonded on both sides to a factory applied aluminum foil facing with a minimum thickness of 60 micron internal and 200 micron external. The standard panel is to be no less than 1.2" (30mm) in thickness.

D. Acceptable Manufacturers: AQC Insutries Pal Duct (www.aqcind.com)

E. All duct construction shall strictly adhere to the following requirements:
   1. All duct segments to be fabricated, handled and installed in accordance with the manufacturer's Installation Instructions.
   2. Duct segments are to be constructed utilizing the V-groove method of fabrication which leaves the outer 200 micron aluminum liner in tact. All external seams shall be taped and all internal seams shall be fully sealed with an unbroken layer of adhesive or silicon as detailed by manufacturers Installation Instructions. Each duct segment shall be connected as required by manufacturer guidelines with manufacturer approved connectors in accordance with the manufacturers Installation Instructions. Duct reinforcement shall be applied to protect against side deformation from both positive and negative pressure per the manufacturers Installation Instructions based on ductwork size and system pressure.
   3. All fabricated duct segment fittings shall be designed in accordance with "SMACNA HVAC Duct Construction Standards" latest edition for non-metal ducts.

PART 3 EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. All air distribution ductwork shall be fabricated, erected, and supported, in accordance with all applicable standards of SMACNA, where such standards do not conflict with NFPA 90A, and where class of construction equals or exceeds that noted herein.

C. Duct systems have been designed for metal ducts. Fibrous glass duct (duct board) may not be substituted for metal duct.

D. Install ducts with fewest possible joints. Install round and flat-oval ducts in maximum practical lengths.

E. Limit transition angles to to 15-degrees diverging and 30-degrees converging (each side).

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening with sheet metal flanges of the same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Provide sheet metal collars where ducts are exposed to view (including mechanical rooms) and where ducts pass thru walls, floors, or ceilings.

L. Install all automatic control dampers and other devices furnished by others. Coordinate sizes, blank-off plates, etc. Provide for an airtight seal.

M. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements for fire and smoke dampers.

N. Do not install duct sealants when temperatures are less than recommended by sealant manufacturers. Maintain temperatures within acceptable range during and after installation of duct sealant.

O. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

P. Cleaning: Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums, scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3.02 FLEXIBLE CONNECTIONS

A. Connections to inlet and discharge openings of fans shall be made with a section of at least 1/16-inch thick neoprene coated fiberglass fabric. Flex connections shall not be less than 3-inches long and shall have at least 1-inch of slack.

B. Connections shall have angle frames at each end for rectangular ducts, and metal tension bands at each end for round ducts.

C. Connections shall be installed on straight duct sections, not transitional fittings, and allow for easy replacement.

D. Connections to units that have internally isolated fans within the unit housing will not require flex connections, unless otherwise indicated.

3.03 APPLICATION OF DUCT LINER

A. Factory or Shop Application of Duct Liner: Comply with SMACNA (DCS), Figure 7-11, "Flexible Duct Liner Installation."

B. 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.

C. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

D. Butt transverse joints without gaps, and coat joint with adhesive.

E. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

F. 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.

G. 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.

H. 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 fan discharges, and intervals of lined duct preceding unlined duct.

I. Terminate inner ducts with build-outs attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build-outs (metal hat sections) or other build-out means are optional; when used, secure build-outs to duct walls with bolts, screws, rivets, or welds.

3.04 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Utilize flange connection systems with corner clips or optional nuts and bolts. Install in strict accordance with manufacturer’s instructions.

C. Trim duct gaskets and sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter.

E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.05 UNDERGROUND DUCT INSTALLATION

A. Follow manufacturer's installation instructions. 10 Year Manufacturer's warranty requires all installing contractors to be certified by AQC Industries prior to installation.

B. Excavate a trench evenly as per the manufacturer's manual. No bedding is required except for cases of bedrock or clay where sand or light aggregate may be used.

C. Backfill material may consist of pea gravel, sand or excavated material, if equivalent. Backfill should not contain particles larger than 3/4 inch.

D. Hand tamp backfill material to hold in place. Do not allow heavy loads to travel over backfilled duct, as crushing may occur.

E. Duct assembly per manufacturer's manual:
   1. Cut piping material with circular or reciprocating
   2. For ducts 18" and smaller, apply gaskets & clamps for duct assembly.
   3. For take-offs, saddles, plenums or diffuser boots, apply sealant and screws.

F. Only manufacturer approved and supplied materials may be used.

3.06 PHENOLIC FOAM PRE-INSULATED DUCT INSTALLATION

A. The contractor responsible for the fabrication and installation of the phenolic foam pre-insulated ductwork.

B. The contractor shall be certified by the manufacturer of the phenolic foam pre-insulated ductwork.

C. Handling: Care shall be exercised in the handling and transport of duct segments in order to prevent objectionable aesthetic damage to the outer surface. Storage of duct segments shall be under cover and all material protected from the environment prior to installation.

D. Installation: Duct segments shall be installed by authorized contractors in accordance with the manufacturers installation instructions. It is the responsibility of the contractor to ensure that the ductwork system is properly and adequately supported. It shall be the responsibility of the contractor to ensure that the chosen connection system is compatible with the specific ductwork system. Supports on straight runs of ductwork shall be positioned at centers not exceeding 13 feet (3.96 m) for duct sections when fabricated in 13 foot (3.96 m) lengths with sides up to 46"(1168 mm). Larger duct sizes and short segments (4 feet long) (1220 mm) are supported at 6 foot centers or less, in accordance with the manufacturers Installation Instructions. Additionally, ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, and all duct accessories such as dampers, etc. The load of such accessories to the ductwork shall be neutralized by the accessory support.

E. Air Leakage: Duct air leakage rates to be in compliance with "SMACNA HVAC Duct Construction Standards" latest version per applicable leakage class based on pressure.

F. Outdoor Installations: All externally mounted ductwork shall be protected against the elements with a weatherproof finish per the "Phenolic System Design Guide." The finish shall be either the standard 200 micron aluminum outer liner or VentureClad 1577CW or equal.
   1. Aluminum Clad: Duct segments shall incorporate 0.0079" (0.20 mm) minimum thickness aluminum sheet which is introduced during the fabrication process as detailed in the "Phenolic System Design Guide." All external seams and joints shall be fully sealed with clear silicon and foam tape. Supports and reinforcement shall both be per SMACNA.
   2. Duct segments shall incorporate 6.0 mils thickness 5-ply aluminum, zero permeability, absolute vapor barrier self adhesive jacketing. Jacketing can be externally applied after duct installation or introduced during the fabrication process as detailed in the "Phenolic System Design Guide". All external seams and joints shall be fully sealed with jacketing

butt strips of equal material in accordance with the manufacturer installation guidelines. Acceptable Manufacturers: VentureClad 1577CW, High Cube HC2515 or approved equal.

3.07 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA (DCS), Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA (DCS), Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. All supports shall be from joists, beams, or other structural members. Do not support from roof decking. Install channel framing to span bar joists.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Straps may be used to support rectangular ducts 60-inches wide or smaller. Use trapeze hangers with rods and angles or channel to support rectangular duct larger than 60-inches wide.

H. Hangers Exposed to View: Threaded rod and angle or channel supports.

I. Use double nuts and lock washers on threaded rod supports.

3.08 DUCT LEAKAGE TESTING

A. Testing equipment, procedure and reports shall be in accordance with the latest edition of the SMACNA HVAC Air Duct Leakage Manual.
   1. Equipment shall include, but not be limited to, a blower with volume control, manometer, and orifice meter with pressure differential manometer.
   2. Ductwork shall be tested in partial segments as work progresses before concealment and application of external insulation.
   3. Manometer readings shall be converted to cubic feet per minute from a calibrated test curve.
   4. Total allowable leakage shall not exceed 1-percent of the total system design airflow rate.

B. The following ducts shall be tested:
   1. Rectangular ducts with a pressure classification of 4” w.g. or greater shall be tested with a leakage classification of 6 at design pressure classification.
   2. Round ducts with a pressure classification of 4” w.g. or greater shall be tested with a leakage classification of 3 at design pressure classification.

C. Design pressure for testing ductwork shall be determined from the maximum pressure generated at the fan discharge at the nominal motor horsepower installed or the stated pressure class, whichever is greater.

D. Leaks identified during inspection or testing shall be repaired.
   1. All leaks shall be found audibly or visually with smoke.
   2. All leaks shall be repaired or the joints remade, and testing repeated until acceptable results are achieved.

3. Leaks shall be repaired by complete removal of the sealant materials, thorough cleaning of the joint surfaces, and reinstallation of multiple layers of sealing materials.

E. All low pressure duct systems, positive or negative, shall be inspected for visual and audible signs of leakage.

F. Leaks that cause objectionable noise in the opinion of the Owner or engineer, must be repaired regardless of the amount of leakage.

G. The contractor shall notify the architect seven days in advance of when duct pressure testing is planned so the Owner or engineer has the option to observe the tests.

3.09 DUCT CLEANING

A. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

B. Ductwork shall be kept sealed and cleaned prior to and after installation. All ductwork not kept clean, in the opinion of the architect, will be replaced at no additional cost to the project.

C. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums, scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, filters and filter sections, and drains.

3.10 DUCT SCHEDULE

A. Seal Class Requirements: All ductwork, including low pressure ductwork, shall be sealed to SMACNA Seal Class A, with all joints, seams, and penetrations sealed.

B. Leakage Class Requirements: All rectangular ductwork shall be SMACNA Leakage Class 6, and all round ductwork shall be SMACNA Leakage Class 3.

C. Primary Supply Air Ducts (upstream of variable volume terminal units):
1. Material: Galvanized sheet steel.
2. Pressure Class: Positive 4-inches water gauge.
3. Seal Class: A, all joints, seams, and penetrations sealed.
4. Leakage Class: 6 rectangular, 3 round.

D. Secondary Supply Air Ducts (downstream of variable volume terminal units):
1. Pressure Class: Positive 2-inches water gauge.

E. Return Air and Outdoor Air Ducts:
1. Pressure Class: Negative 2-inches water gauge.

F. Exhaust Air and Relief Air Ducts:
1. Pressure Class: 2-inches water gauge, positive or negative.

G. Underground Supply or Return Air Ducts:
1. Material: HDPE closed cell plastic.
2. Pressure Class: Per mfgr.
3. Seal Class: Per mfgr.

H. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

I. Liner:
1. All Air Ducts: Fibrous lass, Type I, 1-inch thick.

END OF SECTION

SECTION 23 3300 - HVAC DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers.

B. Combination fire and smoke dampers.

C. Duct access doors.

D. Insulated flexible duct.

E. Flexible connections.

F. Branch connections.

G. Volume control dampers.

H. Turning vanes.

I. Pipe portal systems.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
   2. NFPA 96 - Standard Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. Sheet Metal and Air-Conditioning Contractors National Association:
   1. SMACNA (DCS) - HVAC Duct Construction Standards.

D. Underwriters Laboratories:
   1. UL 33 - Heat Responsive Links for Fire-Protection Service.

1.04 ACTION SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Drawings: Record actual locations of access doors and test holes.

B. Operation and Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views, etc.

1.06 QUALITY ASSURANCE

A. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

B. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: louvers-dampers.com.
   2. Ruskin Company: ruskin.com.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: louvers-dampers.com.
   2. Ruskin Company: ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

G. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Elgen Manufacturing: elgenmfg.com.
   2. Ruskin Company: ruskin.com.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch (25 mm) thick insulation with sheet metal cover.
   1. Less Than 12 inches (300 mm) Square: Secure with sash locks.
   2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches (600 x 1200 mm): Three hinges and two compression latches .
   4. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 INSULATED FLEXIBLE DUCT

A. Manufacturers:
   1. Hart and Cooley: hartandcooley.com
   2. Thermaflex: thermaflex.net

B. Fabrication: UL 181, Class 1, two-ply vinyl or black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

2.05 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
   1. Carlisle HVAC Products: carlislehvac.com.
   2. Elgen Manufacturing: elgenmfg.com.

B. Fabrication: In accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m), approximately 2 inches wide.
   2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.

2.06 BRANCH CONNECTIONS

A. Manufacturers:
   1. Hercules Industries: herculesindustries.com.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Rectangular sheet metal branch duct take-offs shall be fabricated with 45 degree entry fittings in accordance with SMACNA standards. Branch ducts shall include opposed action type multi-blade dampers where indicated on the drawings.

D. Sheet metal take-offs between rectangular and round ductwork shall be with conical bell-mouth type spin-ins, where duct sizes permit. Each fitting shall have a single blade quadrant locking damper as an integral part of the fitting. Fittings shall be Hercules bell-mouth spin-in, Hercules high efficiency take-off, or equivalent.

2.07 VOLUME DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   1. Hercules Industries: herculesindustries.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch (150 x 760 mm).
   1. Blade: 24 gage, 0.0239 inch (0.61 mm), minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch (1.21 mm), minimum.

E. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.08 TURNING VANES

A. Manufacturers:
   1. Ductmate Industries: ductmate.com.
   2. Durodyne: durodyne.com.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.09 MISCELLANEOUS PRODUCTS

A. Moisture Drains:
   1. Moisture drains shall be of 12 gauge galvanized steel, 3.5-inch diameter, with 3/4-inch threaded drain, designed to draw surrounding duct into a funnel shape and ensure drainage.
   2. Products: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
      a. Ductmate Industries: ductmate.com

B. Pipe Portal Systems:
   1. Pipe portal system shall include an 18 gauge galvanized roof curb with integral base plate, continuously welded corner seams, factory-installed wood nailer, and 1-1/2 inch rigid fiberglass insulation.

2. An EPDM compression molded cap shall be utilized. All caps shall include stainless steel snaplock clamps.
3. Attachment and installation of the pipe portal shall be done in accordance with the manufacturer's instructions and the roofing membrane manufacturer's instructions.
4. Products: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   a. Portals Plus, Inc: commercialproducts group.com

C. Equipment Support Rails:
1. Equipment rails shall be fabricated of 18 gauge galvanized steel with built-in cant, monolithic construction with integral base plate and continuous mitered and welded corner seams, with factory installed wood 2x4 nailer.
2. Each equipment rail shall include a matching 18 gauge galvanized steel counter-flashing cap with integral drip edge, all corners mitered and welded, with screws for attachment.
3. Equipment rails over 3 feet long shall incorporate 14 gauge internal gussett reinforcing. Rail height to provide 6" clearance above the final roof surface, with a vertical step at the bottom (contractor verified) for insulation thickness.
4. Products: Subject to compliance with requirements, available manufacturers that may be incorporated into the work include, but are not limited to the following:
   a. Roof Products and Systems: commercialproductsgroup.com

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 DUCT INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to the Ductwork section for duct construction and pressure class.

C. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch (100 x 100 m) for balancing dampers only. Review locations prior to fabrication.

E. Provide duct test holes where indicated and required for testing and balancing purposes.

F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

3.03 FLEX DUCT INSTALLATION

A. Install insulated flexible ducts in accordance with SMACNA (DCS).

B. Support with bands 1-1/2" wide and spaced a maximum of 48-inches apart. maximum centerline sag between supports shall not exceed 1/2-inch per 12-inches.

C. Do not bend flexible ducts across sharp corners, and avoid contact with fixtures, water lines, and conduits.

D. Install fully extended, in a direct line, without sags, twists, or turns. Bends shall not be less than one duct diameter.

E. Connect to diffusers and metal ducts with maximum 60-inch lengths of flexible ducts clamped or strapped in place.
   1. Tape the inner liner to the hard duct or device collar.
   2. Attach two nylon straps; one on the inner liner and one for the outer shell.
   3. Fold the outer shell inside itself before wrapping the hard duct.
   4. Install hard duct elbows at diffusers or "flexflow" radius forming elbows.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inline centrifugal fans.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 INLINE CENTRIFUGAL FANS

A. Manufacturers:
   1. Greenheck Fan Corporation; _____: www.greenheck.com.
   2. Loren Cook Company; _____: www.lorencook.com.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

B. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.04 QUALITY ASSURANCE

A. Test and rate louver performance in accordance with AMCA 500-L.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ruskin: www.ruskin.com.

2.02 LOUVERS

A. Type: 6 inch (150 mm) deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over exhaust and 1/2 inch (13 mm) square mesh screen over intake.

B. Fabrication: 16 gage, 0.0598 inch (1.52 mm) thick galvanized steel welded assembly, with factory prime coat finish.

C. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 3710 - GRILLES REGISTERS AND DIFFUSERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grilles, registers, and diffusers.

1.02 RELATED REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project, unless identified by a specific edition date. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

B. American Society of Heating, Refrigeration, and Air-Conditioning Engineers:
   1. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors' National Association:
   1. SMACNA (DCS) - HVAC Duct Construction Standards.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   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. Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide basis of design products indicated on the drawings or comparable products by one of the following:
   1. Krueger: krueger-hvac.com.
   2. Titus: titus-hvac.com.
   3. Metal-Aire: metalindustries.com

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square and rectangular, multi-louvered diffuser to discharge air in two way and four way pattern .

B. Connections: As scheduled on drawings.

C. Frame: Provide surface mount and inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Aluminum with baked enamel finish.

E. Color: As shown on drawings.

2.03 SURFACE SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades to discharge air along face of grille, two-way deflection.

B. Frame: 1 inch (25 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions with factory enamel finish.

D. Color: As shown on drawings.

E. Damper: Where scheduled, integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.04 EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical face.

B. Fabrication: Steel and aluminum with 20 gauge minimum frame, or aluminum extrusions, with factory enamel finish.

C. Frame: 1 inch (25 mm) margin with countersunk screw mounting.

D. Color: As shown on the drawings.

E. Damper: Where scheduled, integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.05 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 x 1/2 x 1/2-inch grid core.

B. Fabrication: Grid core consists of aluminum with baked enamel finish.

C. Color: As shown on the drawings

D. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

E. Frame: Channel lay-in frame for suspended grid ceilings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Install in accordance with manufacturer's instructions. Install level and plumb.

C. Ceiling-Mounted Outlets and Inlets:
   1. 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.
   2. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel.
   3. Make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, extractors, and fire dampers.

E. After installation, adjust diffusers, grilles, and registers to air patterns indicated, or as directed, before starting air balancing.

F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, where dampers are not specified as part of the air device assembly.

G. Paint ductwork visible behind air outlets and inlets matte black.

3.02 SCHEDULES

A. See equipment schedules on the drawings for Basis of Design.

END OF SECTION

SECTION 23 7223 - PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Energy recovery units.

B. Vibration isolation.

C. Power and controls.

D. Accessories.

E. Service accessories.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

B. NFPA 70 - National Electrical Code.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Firm regularly engaged in manufacturing energy recovery units..
   2. Products in satisfactory use in similar service for not less than five years.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in manufacturer's unopened packaging.

B. Store products to be installed indoors in dry, heated area.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Warranty energy recovery wheel to be free from defects in material and workmanship for 3 years under circumstances of normal use.

C. Warranty motor to be free from defects in material and workmanship for 7 years under circumstances of normal use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Energy Recovery Ventilators:
   1. Semco Inc.; ____: www.semcohvac.com.
   2. Renewaire: www.renewaire.com.
   3. Tempeff: www.tempeff.com

2.02 ENERGY RECOVERY UNITS

A. Energy Recovery Units: Coretype; prefabricated packaged system designed by manufacturer.
   1. Access: Hinged access panels on front.
   2. Lifting holes at the unit base.
   3. Framing: Welded extruded aluminum tubular frame capable of supporting components and casings.
   4. Permanent name plate listing manufacturer mounted inside door near electrical panel.

2.03 CASING

A. Wall, Floor, and Roof Panels:

1. Construction: 2 inch (50.8 mm) thick, double wall box construction, with formed edges of exterior wall overlapping formed edges of interior wall.
2. Exterior Wall: Galvanized steel sheet.
   a. 0.040 inch (1 mm) thick aluminum.
3. Interior Wall: Galvanized sheet metal.
   a. 22 gage, 0.0299 inch (0.76 mm) galvanized sheet metal.
4. Insulation:
   a. 2 inch (50 mm) insulated fiberglass.
   b. Panel Cores: Mineral wool board.
   c. Bacteria Resistance: No growth when tested according to UL 181.
   d. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
   e. Smoke Developed Index (SDI): 50, maximum, when tested in accordance with ASTM E84 or UL 723.
5. Roof Panel: Weatherproof.
6. Isolation and Seal: Form continuous, thermally isolated, weather tight seal between inner wall of panels and structural framing with closed cell PVC foam gasketing.
7. Coating: Polyurethane enamel.

B. Access Panels: Provide access to components through a large, tightly sealed and easily removable panel.

C. Doors:
1. Construct doors of same construction and thickness as wall panels.
2. Hardware:
   a. Hinges: Aluminum.
   b. Provide exterior handle and interior 3-point latching device.
   c. Prop Rod: Capable of propping doors in open position.
   d. Label each door to identify equipment located within.

D. Duct Connection Collars: 0.08 inches (2 mm) aluminum, continuously welded.

2.04 FANS

A. Provide separate fans for exhaust and supply blowers.

B. Fans:
1. Individually driven with a dedicated motor.
2. AMCA-rated.
3. Provide with non-overloading characteristics.

C. Bearings:
1. Pillow block.
2. Bearings: Permanently lubricated sealed ball bearings.
3. Rated for not less than 200,000 hours of operation with accessible greased fittings.

D. Housings: 12 gage, 0.1046 inch (2.66 mm) aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.

E. Motors:
1. Motors: Open drip proof.
2. Efficiency: High.
3. Speed: Single.
4. Control: Constant Speed.
5. Fan Motor: UL listed and labeled.

F. Drives:
1. Fans: Belt driven.
2. Horsepower: 7.5 HP (5.2 kW).
3. Service Factor: 1.2.

2.05 FILTERS

A. Exhaust and Fresh Air Streams: MERV 7 filters constructed to meet ASHRAE Std 52.2.

B. Filter Racks: Bolt-on rack constructed of 0.08 inch (2 mm), minimum, thick aluminum with hinged side access door and snap fasteners.

C. Filter Removal Hooks: Provide means to remove filters that are not immediately accessible from exterior of unit

D. Provide spare set of filters.

2.06 DAMPERS

A. Return Air Damper:
   1. Factory installed, adjustable volume control, opposed blade damper for regulating airflow, based on external static pressure.
   2. Return Air Damper: Structural hat channels, reinforced at corners.
   3. Roll-formed Frames: Structurally superior to 13 gage, 0.0897 inch (2.28 mm) U-channel frames.
   4. Blades: Single skin, 16 gage, 0.0598 inch (1.52 mm).

B. Motorized Dampers: Provide motorized dampers at outside air inlet, exhaust air outlet, and supply air outlet.
   1. Type: Motorized two position parallel blade damper with blade seals.
   2. Motorized Damper: Roll-formed structural hat channels, reinforced at the corners,
   3. Formed from single piece of minimum 16 gage, 0.0598 inch (1.52 mm) galvanized steel.
   4. Blades: Single skin, 16 gage, 0.0598 inch (1.52 mm).
   5. Blade Edge Seals: PVC coated polyester fabric suitable for minus 25 degrees F (32 degrees C) to 180 degrees F (83 degrees C).
   6. Jamb Seals: Flexible stainless, compression type to prevent leakage between end of the blade and the damper frame.
   7. Bearings: Corrosion resistant, molded synthetic sleeve type turning in extruded hole in damper frame.
   8. Conceal linkage out of air stream, within damper frame to reduce pressure drop and noise and lessen need for maintenance.

2.07 VIBRATION ISOLATION

A. Vibration Isolation: Provide whole unit vibration isolation with the energy recovery unit assembly.

2.08 POWER AND CONTROLS

A. Motor Control Panels: UL listed.

B. Include necessary motor starters, fuses, transformers and overload protection according to NFPA 70.

C. Provide single-point field connection to power supply.

D. Install wiring in accordance with NFPA 70.

2.09 ACCESSORIES

A. Electric Preheat Coil:
   1. Resistance coil type with elements enclosed in a steel sheath with fins and painted with a baked-on aluminum paint for long life in a 100% fresh air stream.
   2. Coil: UL listed and constructed in accordance with NFPA 70 requirements.

2.10 SERVICE ACCESSORIES

A. Electrical Components: Factory wired for single point power connection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.02 INSTALLATION

A. Provide openings for suitable ductwork connection.

3.03 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.04 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION

SECTION 23 8129 - VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.

C. ITS (DIR) - Directory of Listed Products.

D. NFPA 70 - National Electrical Code.

E. UL 1995 - Heating and Cooling Equipment.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Compressors: Provide manufacturer's warranty for sten (10) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of Daikin AC (Americas), Inc. according to Daikin's terms and conditions. All warranty service work shall be preformed by a Daikin factory trained service professional.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: The system design shown in the contract documents is based on equipment and system designed by Daikin AC; www.daikinac.com.

B. Systems manufactured by other manufacturers will not be considered.

2.02 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.

3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
4. Conditioned spaces are shown on the drawings.
5. Outdoor/Condenser unit locations are shown on the drawings.
6. Indoor/Evaporator unit locations are shown on the drawings.
7. Branch selector unit locations are not shown on the drawings.
8. Required equipment unit capacities are shown on the drawings.
9. Connect equipment to condensate piping provided by others; condensate piping is shown on the drawings.

B. Cooling Mode Interior Performance:
1. Daytime Setpoint: 68 degrees F (20 degrees C), plus or minus 2 degrees F (1 degrees C).
2. Setpoint Range: 57 degrees F (14 degrees C) to 77 degrees F (25 degrees C).
3. Night Setback: 78 degrees F (25 degrees C).
4. Interior Relative Humidity: 20 percent, maximum.

C. Heating Mode Interior Performance:
1. Daytime Setpoint: 68 degrees F (20 degrees C), plus or minus 2 degrees F (1 degrees C).
2. Setpoint Range: 59 degrees F (15 degrees C) to 80 degrees F (27 degrees C).
3. Night Setback: 60 degrees F (15 degrees C).
4. Interior Relative Humidity: 10 percent, minimum.

D. Operating Temperature Ranges:
1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F (minus 20 degrees C) to 60 degrees F (16 degrees C) dry bulb.

E. Controls: Provide the following control interfaces:
1. One central remote control panel for entire system; locate where indicated.

F. Local Controllers: Wall-mounted, wired, containing temperature sensor.

2.03 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
2. Refrigerant: R-410A.
3. Performance Certification: AHRI Certified; www.ahrinet.org.
4. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
5. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
6. Provide units capable of serving the zones indicated.
7. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

B. Electrical Characteristics:
1. Power - Condensing Units: 208 to 230 Volts, 3-phase, 60 Hz.
2. Power - Branch Selector Units: 208 to 230 Volts, single phase, 60 Hz.
3. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
4. Control: 16 volts DC.

C. Unit Controls: As required to perform input functions necessary to operate system; provided by manufacturer of units.
1. Provide interfaces to remote control and building automation systems as specified.

D. Wiring:
1. Control Wiring: 18 AWG, 2-conductor, non-shielded, non-polarized, stranded cable.

E. Refrigerant Piping:

1. Provide three-pipe refrigerant system, including high/low pressure dedicated hot gas, liquid and suction lines; two-pipe systems utilizing lower temperature mixed liquid/gas refrigerant to perform heat recovery are not permitted due to reduced heating capabilities.
2. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.
3. Insulate each refrigerant line individually between the condensing and indoor units.

2.04 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
2. Refrigerant: Factory charged.
3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
6. Sound Pressure Level: As specified, measured at 3 feet (one meter) from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
8. Provide refrigerant auto-charging feature and refrigerant charge check function.
9. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
10. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
11. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
12. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
1. Provide minimum of 2 fans for each condensing unit.
2. External Static Pressure: Factory set at 0.12 in WG (30 Pa), minimum.
3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG (80 Pa), minimum; provide for mounting of field-installed ducts.
4. Fan Airflow: As indicated for specific equipment.
5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
   2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
   3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
   4. Provide oil separators and intelligent oil management system.
   5. Provide spring mounted vibration isolators.

2.05 BRANCH SELECTOR UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
   2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   5. Refrigerant Connections: Braze type.
   6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.06 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. Provide thermistor on liquid and gas lines.
   4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   5. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
      a. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
   6. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
   1. Sound Pressure: Measured at low speed at 5 feet (1.5 m) below unit.
   2. Provide external static pressure switch adjustable for high efficiency filter operation
   3. Condensate Pump: Built-in, with lift of 9 inches (229 mm), minimum.

4. Switch box accessible from side or bottom.
5. Product(s):
    a. Daikin FXMQ_P Series; three-speed direct-drive DC (ECM) type fan with automatic airflow adjustment; external static pressure selectable during commissioning.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.

B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.

C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.03 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to inspect installation prior to startup.

3.04 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform system startup.

B. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

C. Adjust equipment for proper operation within manufacturer's published tolerances.

3.05 CLEANING

A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.06 COMMISSIONING

A. Replace components not functioning properly.

3.07 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.
    1. Use operation and maintenance data as reference during demonstration.
    2. Conduct walking tour of project.
    3. Briefly describe function, operation, and maintenance of each component.

3.08 PROTECTION

A. Protect installed components from subsequent construction operations.

B. Replace exposed components broken or otherwise damaged beyond repair.

3.09 MAINTENANCE

A. Provide a separate maintenance contract for the service and maintenance of the entire HVAC system for 6 years from Date of Substantial Completion from the system installer. This number shall be subjuect to yearly (5 years total) renewal. See bid form for Alternate #2.

END OF SECTION

SECTION 23 8130 - BASIS OF DESIGN VRV EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment characteristics for VRV HVAC system.

1.02 RELATED REQUIREMENTS

A. Section 23 8129 - Variable Refrigerant Volume (VRV) HVAC System: Description of system, performance requirements, fundamental equipment requirements.

PART 2 PRODUCTS

2.01 OUTDOOR/CONDENSER UNITS

A. VRV Unit HRU-1 and 2: Air-cooled heat recovery heat pump.
   1. Product: Daikin REYQ168.
   2. Cooling Capacity: 168,000 Btu/h (49 kW).
   3. Heating Capacity: 188,000 Btu/h (55 kW).
   4. Simultaneous Cooling/Heating Operating Range: minus 4 degrees F (minus 20 degrees C) to 60 degrees F (16 degrees C) wet bulb.
   5. Sound Pressure: 61 dB(A).
   6. Power Supply: 208-230 V/3 Phase/60Hz.

2.02 BRANCH SELECTOR BOXES

A. VRV Unit See Plans: Branch Selector Box.
   1. Product: Daikin BSQ36.
   2. Maximum Connectable Cooling Capacity: 36,000 Btu/h (11 kW).
   3. Operating Sound Pressure: 42 dB(A).
   4. Number of Connectable Indoor Units: 5.
   5. Power Supply: 208-230 V/1 Phase/60Hz.

B. VRV Unit See Plans: Branch Selector Box.
   1. Product: Daikin BS_Q54.
   2. Maximum Connectable Cooling Capacity: 60,000 Btu/h (18 kW).
   3. Operating Sound Pressure: 43 dB(A).
   4. Number of Connectable Indoor Units: 8.
   5. Power Supply: 208-230 V/1 Phase/60Hz.

2.03 INDOOR UNITS

A. VRV Unit See Plans: Concealed-in-ceiling unit.
   1. Product: Daikin FXMQ12P.
   2. Cooling Capacity: 12,000 Btu/h (3,517 W).
   3. Heating Capacity: 13,500 Btu/h (3,956 W).
   4. Airflow: Three speed, 246 cubic feet per minute (0.12 cubic meters per second) at low, 282 cubic feet per minute (0.13 cubic meters per second) at medium, 335 cubic feet per minute (0.16 cubic meters per second) at high.
   5. Sound Pressure: 29 dB(A) at low, 34 dB(A) at high.
   6. External Static Pressure: 0.12 inches w.g. (30 Pa) at low speed, 0.40 inches w.g. (100 Pa) at high speed.
   7. Built-in condensate pump with a pump lift of 18-3/8 inches (467 mm), minimum.
   8. Unit Height: 11-13/16 inches (300 mm).

B. VRV Unit See Plans: Concealed-in-ceiling unit.
   1. Product: Daikin FXMQ18P.
   2. Cooling Capacity: 18,000 Btu/h (5,275 W).
   3. Heating Capacity: 20,000 Btu/h (5,861 W).
   4. Airflow: Three speed, 529 cubic feet per minute (0.25 cubic meters per second) at low, 532 cubic feet per minute (0.28 cubic meters per second) at medium, 635 cubic feet per minute (0.30 cubic meters per second) at high.

5. Sound Pressure: 37 dB(A) at low, 41 dB(A) at high.
6. External Static Pressure: 0.20 inches w.g. (50 Pa) at low speed, 0.80 inches w.g. (199 Pa) at high speed.
7. Built-in condensate pump with a pump lift of 18-3/8 inches (467 mm), minimum.
8. Unit Height: 11-13/16 inches (300 mm).

C. VRV Unit See Plans: Concealed-in-ceiling unit.
1. Product: Daikin FXMQ24P.
2. Cooling Capacity: 24,000 Btu/h (7,034 W).
3. Heating Capacity: 27,000 Btu/h (7,913 W).
4. Airflow: Three speed, 565 cubic feet per minute (0.27 cubic meters per second) at low, 618 cubic feet per minute (0.29 cubic meters per second) at medium, 688 cubic feet per minute (0.33 cubic meters per second) at high.
5. Sound Pressure: 38 dB(A) at low, 42 dB(A) at high.
6. External Static Pressure: 0.20 inches w.g. (50 Pa) at low speed, 0.80 inches w.g. (199 Pa) at high speed.
7. Built-in condensate pump with a pump lift of 18-3/8 inches (467 mm), minimum.
8. Unit Height: 11-13/16 inches (300 mm).

D. VRV Unit See Plans: Concealed-in-ceiling unit.
1. Product: Daikin FXMQ30P.
2. Cooling Capacity: 30,000 Btu/h (8,792 W).
3. Heating Capacity: 34,000 Btu/h (9,964 W).
4. Airflow: Three speed, 706 cubic feet per minute (0.33 cubic meters per second) at low, 794 cubic feet per minute (0.38 cubic meters per second) at medium, 882 cubic feet per minute (0.42 cubic meters per second) at high.
5. Sound Pressure: 39 dB(A) at low, 43 dB(A) at high.
6. External Static Pressure: 0.20 inches w.g. (50 Pa) at low speed, 0.80 inches w.g. (199 Pa) at high speed.
7. Built-in condensate pump with a pump lift of 18-3/8 inches (467 mm), minimum.
8. Unit Height: 11-13/16 inches (300 mm).

E. VRV Unit See Plans: Concealed-in-ceiling unit.
1. Product: Daikin FXMQ48P.
2. Cooling Capacity: 48,000 Btu/h (14 kW).
3. Heating Capacity: 54,000 Btu/h (16 kW).
4. Airflow: Three speed, 988 cubic feet per minute (0.47 cubic meters per second) at low, 1,165 cubic feet per minute (0.55 cubic meters per second) at medium, 1,377 cubic feet per minute (0.65 cubic meters per second) at high.
5. Sound Pressure: 40 dB(A) at low, 44 dB(A) at high.
6. External Static Pressure: 0.20 inches w.g. (50 Pa) at low speed, 0.80 inches w.g. (199 Pa) at high speed.
7. Built-in condensate pump with a pump lift of 18-3/8 inches (467 mm), minimum.
8. Unit Height: 11-13/16 inches (300 mm).

PART 3 EXECUTION

3.01 INSTALLATION

A. Section 23 8129 - Variable Refrigerant Volume (VRV) HVAC System: Description of system, performance requirements, fundamental equipment requirements.

END OF SECTION

DIVISION

26

ELECTRICAL

SECTION 26 0010 - GENERAL ELECTRICAL REQUIREMENTS

PART I - GENERAL

1.01 RELATED DOCUMENTS AND REQUIREMENTS

A. Specifications throughout all divisions of the project manual are directly applicable to this section, and this section is directly applicable to them.

B. Drawings, specification sections and other documents which form the basis for the Contract apply to all work of Division 26, Division 27, and Division 28.

1.02 SUMMARY

A. This section includes general requirements for electrical work and is supplemental and in addition to the requirements of Division 01. Section applies to work of all Division 26, Division 27, and Division 28 sections.

B. It is the intent of Division 26, Division 27, and Division 28 and the contract drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete electrical system.

C. Provide all materials, appliances, apparatus, safety precautions, programs and methods, whether specifically mentioned or not, which are necessary for a complete electrical installation.

1.03 REGULATORY REQUIREMENTS

A. Errors and omissions in the Contract Documents do not relieve the contractor from providing the work in accordance with regulatory requirements.

B. As a minimum, execute, test and inspect work in accordance with Underwriters and State and Local codes, rules, and regulations applicable to the trade involved. If plans or specifications call for requirements in excess of these codes, rules and regulations, the greater requirement shall apply. Included are the requirements of IBC, NFPA, NEC, OSHA, NEMA, ICEA, ANSI, ASTM, UL, EIA\TIA, UBC, and Federal Specifications.

C. Obtain and pay for all permits, licenses, and inspections required by laws, ordinances and rules that govern the work of this project.

D. Where a conflict between Division 26, Division 27, and Division 28 drawings and specifications arise, The specifications shall take precedence.

E. All materials furnished and all work installed shall comply with locally adopted, international, or uniform building and fire protection codes, with the requirements of local utility companies, and with the requirements of all governmental authorities having jurisdiction.

1.04 DRAWINGS

A. The drawings are to scale as noted; however refer to the architectural plans for exact building dimensions and civil plans for exact site dimensions. Do not scale electrical drawings.

B. Drawings are diagrammatic. No attempt has been made to show every conduit, fitting, device, connection or detail of construction.

C. Consult other drawings of the project for correlating information. Pay particular attention to door swings, casework, fixed furniture, piping, radiation and structural steel. No additional compensation will be allowed for the moving of misplaced items.

D. Since drawings are at a small scale, outlets, devices, equipment, etc., are indicated only in their approximate locations. Verify final locations for rough-ins with field measurements and with the requirements of the equipment to be installed. In the event of conflicts with other systems or building components, notify the Architect whose decision will govern. Make changes required to correct conflicts at no change in contract cost to the Owner.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

1.05 PROJECT COORDINATION

A. Project Coordinator: General Contractor (GC)

B. Make the following types of submittals to Architect through the Project Coordinator:
   1. Preconstruction Submittals
      a. Requests for Substitution.
      b. Proposed Product Lists.
      c. Shop drawings, product data, and samples.
      d. Coordination Drawings.
      e. Manufacturer's Instructions.
   2. Construction Submittals
      a. Requests for Interpretation.
      b. Proposal Requests
      c. Credit/Deduct Change Orders
   3. Substantial Completion Submittals
      a. Source Quality Control Test Reports
      b. Field Quality Control Test and Inspection Reports.
      c. Schedule of Owner Training.
   4. Closeout Submittals
      a. Corrected Test and Inspection Reports.
      b. Certification of Owner Training.
      c. Maintenance Materials.
      d. Operation & Maintenance Manuals.
      e. Inspector Certificates of Acceptance
      f. Warranty Certificates

C. Coordinate work with other Contractors and trades doing work on the project. Examine drawings and specifications of other trades for construction details. Make every effort to prevent conflicts or interferences with other trades.

D. Before ordering equipment, determine that equipment will pass through building openings and passageways that provide unobstructed access to final equipment locations. Determine that equipment will properly fit in the designated space without conflict with other systems, and that Code required spaces and access can be maintained.

E. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

F. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

G. Comply with working clearances identified in Article 110-26 of the current adopted addition of the NEC and coordinate with Division 22 and Division 23 subcontractor to insure that no piping, ductwork or equipment is installed in the exclusively dedicated space for switchboards or panelboards within the scope of the NEC.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.06 JOB CONDITIONS

A. Examine the project site prior to bidding and become familiar with all existing conditions that may affect the bid, No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Inspect materials upon arrival at the site and verify conformance with Contract Documents. Containers that are broken, opened, damaged or water marked are unacceptable. All material,

except items specifically designed to be installed outdoors, shall be stored in an enclosed dry building or trailer.

C. Protect work, materials and equipment from theft and damage. Be responsible for any such theft or damage until project acceptance by the Owner.

PART 2 - PRODUCT REQUIREMENTS

2.01 STANDARDS

A. Unless otherwise indicated, provide only first-quality new materials and equipment, free from defects, in first class condition, suitable for the application and for installation in the space provided. Unless specifically required or permitted by the Contract Documents.

B. Unless otherwise indicated, material and equipment shall be the standard current products of manufacturers regularly engaged in the manufacture of such products.

C. Provide material and equipment listed by UL or other approved testing organization wherever standards have been established for that product unless otherwise permitted by the Authority Having Jurisdiction. Custom designed products shall be constructed from UL approved materials and approved by UL as a complete assembly.

D. Where two or more products of the same class are required, provide products of a single manufacturer.

2.02 SUBSTITUTIONS

A. Products are specified by naming one or more manufacturers with a provision for substitutions. Submit any requests for substitution of specified materials not named prior to bidding in accordance with the provisions of Division 01.

B. Provide sufficient material or data to allow evaluation of proposed alternatives and determination of compliance with the Contract Documents. Specifically List any deviations from the Contract Documents.

C. Where such alternatives alter the design or space requirements, include in the proposal, all items of cost for revised design and construction, including the cost of all allied trades involved.

D. Where specific products are mentioned by name or part number, the proposed substitute must meet all the standard services and functionality of the specified system weather explicitly mentioned or not.

E. Division 01 instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

F. All product substitutions shall be by addendum, or with written approval only.

G. Substitutions after the bid will be considered when a product becomes unavailable through no fault of the EC.

H. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

I. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.

J. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.

2.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
   2. Shop Drawing Submittals: Prepared specifically for this Project.
   3. Submit shop drawings and product data as required by various sections of Division 26, Division 27, and Division 28, in accordance with Division 01 . Make submittals to the Architect.
      a. Do not submit directly to the Engineer
   4. Do not use materials and equipment removed from the existing premises, except as specifically permitted by the Contract Documents.

B. Provide submittals for equipment as described in the electrical drawings as well as each section of these electrical specifications, including, but not limited to all sections of Division 26, Division 27, and Division 28.

C. Submittals will be reviewed by the Engineer only for general compliance with the intent of the Contract Documents. Review does not extend to details of construction, dimensions or equipment quantities.

D. Review of submittals and action recommended as a result of review is a courtesy extended to the Contractor by the Engineer. Errors in submittals are the sole liability of the Contractor. Submission of material for review does not alter the Contractors responsibility to comply with the Contract Documents regardless of action noted in the Engineer's review.

E. Submittals shall include all information necessary to properly identify and evaluate all components of the equipment being submitted for review. Any proposed equipment variances from the Contract Documents must be clearly highlighted. If this is not done the Engineer reserves the right to reject such equipment at any time before or after installation.

F. Submittals shall be bound in folders with covers that indicate the project name and equipment included within the folder. The Contractor's review stamp, dated and initialed, shall be on the folder cover or cover page. Provide tab dividers, properly identified, to identify different categories of equipment. If more than one item of equipment is shown on the same catalog page, that equipment which is applicable to the project must be clearly identified.
   1. Contractor's stamp implies that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

G. Incomplete or improperly formatted submittals will not be reviewed.

H. When revised for resubmission, identify all changes made since previous submittal.

2.04 EQUIPMENT HOUSEKEEPING PADS

A. Fixed concrete bases for electrical equipment, including transformer pad requirements, will be provided under Division 03.

B. Coordinate with Division 03 Contractor to assure that all outside corners are beveled, anchor bolts are provided per equipment manufacturer’s recommendations, and that pad horizontal dimensions are 3” larger than the footprint of the equipment on front and sides.

C. Pad depth shall be minimum four inches.

D. Provide anchor bolts, per equipment manufacturer’s directions, to attach equipment to the pads.

E. Product Substitution: For any proposed change in materials, submit request for substitution as described in the Contract Documents.

PART 3 - ADMINISTRATIVE REQUIREMENTS

3.01 NOT USED - REFER TO 01 FOR REQUIREMENTS

PART 4 - EXECUTION REQUIREMENTS

4.01 GENERAL

A. Workmanship shall be first quality and none but competent electricians, licensed in the State of Wyoming, shall be employed. All work shall be performed under supervision of an experienced, and competent foreman, licensed in the State of Wyoming, and in complete compliance with all applicable codes.

B. The finished appearance of electrical work shall be first class. Install systems, materials and equipment level and plumb, and parallel and perpendicular to building components where installed exposed. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components.

C. Follow manufacturer's installation instructions explicitly unless otherwise indicated. Whenever any conflict arises between the manufacturer's instructions and the Contract Documents notify the Architect and comply with Architect's decision. Keep copy of manufacturer's installation instructions on job site available for review at all times.

D. Do no work without proper documents or written instruction. Any work completed without proper authorization will not be considered for additional compensation.

E. Contractor shall replace any improperly executed work at his cost.

F. Install electrical equipment to facilitate servicing maintenance and repair of replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

G. In finished areas ,except as otherwise indicated; conduit and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

H. No back to back electrical boxes inside walls, maintain a 6” inch minimum spacing between boxes and no more than 2 boxes in any joist space.

I. All ceiling mounted devices (i.e. smoke detectors, speakers, light fixtures, etc.) shall be installed centered in ceiling tiles. Coordinate with ceiling installer.

J. Electrical devices are shown on Drawings in approximate locations unless dimensioned. Adjust devices up to five feet if required to accommodate intended purpose.

K. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

L. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

M. Examine and verify specific conditions described in individual specification sections.

N. Verify that utility services are available, of the correct characteristics, and in the correct locations.

O. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions. Protect work of other trades.

4.02 TRANSPORTATION, STORAGE, AND PROTECTION

A. Transport and handle products in accordance with manufacturer's instruction. All transportation costs for Division 26, Division 27, and Division 28 equipment shall be by this contractor.

B. Store and protect products in accordance with manufacturer's instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather-tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection. Certificate of insurance is required for off-site storage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

H. Protect installed work and provide special protection where specified in individual specification sections.

4.03 TEMPORARY LIGHTING AND POWER

A. Temporary Power
   1. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

B. Temporary Lighting
   1. Provide and maintain incandescent lighting for construction operations per OSHA 1926.56.
   2. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
   3. Maintain lighting and provide routine repairs. Replace lamps as required during construction phase. Task lighting for painting and finishing shall be provide by the associated contractor.
   4. Upon completion of the work, remove all temporary facilities from the project site.

C. Promptly notify the architect of any discrepancies discovered.

4.04 CUTTING AND PATCHING

A. Obtain permission from the Architect and coordinate with other trades prior to cutting. Conform to Architect's direction for location and method of cutting. Cut carefully, and only the minimum amount necessary.

B. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Location and description of affected work.
      b. Necessity for cutting or alteration.
      c. Description of proposed work and products to be used.

C. Repair any damage equal to the original condition, at minimum. Use materials and methods acceptable to the Architect.

D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

E. Fit work air tight to conduit and other penetrations through surfaces.

F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with latest approved materials and methods, to full thickness of the penetrated element.

4.05 PAINTING AND CLEANING

A. Touch up panelboards and other items of electrical equipment not “finish painted” under other sections if finished surface is marred or damaged. Use paint furnished by the equipment manufacturer specifically for that purpose.

B. Leave all equipment, lighting fixtures, etc., in clean condition, with all unnecessary labels removed. Use cleaning materials appropriate to the surface and material being cleaned.

C. Clean up and remove all electrical construction debris from the site both prior to final project assessment and after completion of the work.

4.06 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems with Architect, Engineer, And Project Coordinator.

B. Notify General Contractor and Owner seven days prior to start-up of each item.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual Specification Sections, Contractor to require that equipment manufacturer provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

H. Adjust operating products and equipment to ensure smooth and unhindered operation. Refer to individual sections for additional adjustment requirements.

PART 5 - CLOSE OUT REQUIREMENTS

5.01 CLOSEOUT PROCEDURES

A. Notify General Contractor when work is considered ready for Substantial Completion.

B. Provide Substantial Completion Submittals as required by Division 01 and these specifications.

C. Provide close out submittals as required by Division 01 and these specifications.

D. Notify GC when work is considered finally complete.

E. Complete items of work determined by Engineer's final inspection.

F. Turn over complete, legible, set of “red-line” line documents accurately reflecting as-constructed changes to design layouts.

5.02 TESTING AND DEMONSTRATIONS

A. Test and demonstrate that all electrical equipment and systems operate in accordance with the requirements of the Contract Documents and manufacturer's instructions. Repair or replace any equipment or system that fails the tests and demonstrations.

B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

5.03 OPERATING AND MAINTENANCE MANUALS

A. Submit Operating and Maintenance Manuals for the following equipment. Include, as a minimum, all information incorporated in the submittals.
   1. Lighting Fixtures
   2. Lighting Poles
   3. Emergency lighting power system.
   4. Panelboards and Switchboards
   5. Fire Alarm Panel, Devices, and Riser Diagram.
   6. Lighting Control Equipment (Timeclock, Photocell, Relays, Switches, and Enclosure)
   7. Fuses and Connector Kits
   8. Wiring Devices
   9. Safety Switches and Disconnects
   10. Structured Data Cabling and Outlets

B. Make up required operating and maintenance manuals no later than two weeks prior to completion of the project.

C. Include warranties, description of required testing and testing methods and details of routine maintenance.

D. Include recommended replacement parts with names, addresses, and telephone numbers of service organizations that carry the parts in stock.

E. Manuals shall be 8.5x11, bound in hard back binder, suitably labeled for identification. Accordion fold larger sheets to this size. Provide index page and plastic tabs coordinated with the index.

F. Submit one copy of the manual to the Engineer for review, and after review make noted changes. Turn over 3 copies of the final manual to the Owner.

G. The Contract is not complete and final payment to the contractor will not be made until final operating and maintenance manuals are received and accepted.

END OF SECTION

SECTION 26 0519 - CONDUCTORS AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Armored cable.

C. Metal-clad cable.

D. Wire and cable for 600 volts and less.

E. Wiring connectors.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC).

C. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. UL 4 - Armored Cable.

G. UL 486D - Sealed Wire Connector Systems.

H. UL 1569 - Metal-Clad Cables.

1.03 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Field Quality Control Test Reports.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for all panel feeders and underground circuits.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Armored cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed in hollow stud walls and above accessible ceilings for branch circuits up to 20 A.
   2. In addition to other applicable restrictions, may not be used:
      a. Where not approved for use by the authority having jurisdiction.
      b. Where exposed to view.
      c. Where exposed to damage.
      d. For damp, wet, or corrosive locations.

F. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet (1.8 m).

b. Where concealed in hollow stud walls and above accessible ceilings for branch circuits up to 20 A.

2. In addition to other applicable restrictions, may not be used:
   a. Where not approved for use by the authority having jurisdiction.
   b. Where exposed to damage.
   c. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

G. Concealed Dry Interior Locations: Use only building wire in raceway, armored cable, or metal clad cable.

H. Exposed Dry Interior Locations: Use only specified building wire in raceway.

I. Above Accessible Ceilings: Use only building wire in raceway.

J. Wet or Damp Interior Locations: Use only building wire in raceway.

K. Exterior Locations: Use only building wire in raceway.

L. Underground Installations: Use only building wire in raceway.

M. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

N. Aluminum cable is not allowed.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. All branch circuits to to be stranded, #10 AWG to first junction box.

M. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.
    a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
    a. 208Y/120 V, 3 Phase, 4 Wire System:
        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.
        4) Neutral/Grounded: White.
    b. Equipment Ground, All Systems: Green.
    c. Travelers for 3-Way and 4-Way Switching: Purple.
    d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
    a. Size 10 AWG and Smaller: Solid.
    b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

C. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

D. Conductor: Copper.

E. Insulation Voltage Rating: 600 volts.

2.04 ARMORED CABLE

A. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Stranded.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN.

E. Grounding: Combination of interlocking armor and integral bonding wire.

F. Armor: Steel, interlocked tape.

2.05 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Stranded.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Provide dedicated neutral conductor for each phase conductor where indicated or required.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.06 COMMUNICATIONS/INSTRUMENTATION CABLE

A. Communications cabling shall be installed in accordance with all applicable provisions of ANSI/TIA/EIA standards for building telecommunications systems. Individual media cabling will be specified as required for specific functions and usage.

2.07 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   3. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
   6. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install armored cable (Type AC) in accordance with NECA 120.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

I. Terminate cables using suitable fittings.
1. Armored Cable (Type AC):
   a. Use listed fittings and anti-short, insulating bushings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
2. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

P. Insulate ends of spare conductors using twist-on insulated spring connectors

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

T. Use wiring methods indicated.

U. Protect exposed cable from damage.

V. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

W. Use suitable cable fittings and connectors.

X. Neatly train and lace wiring inside boxes, equipment, and panelboards.

Y. Clean conductor surfaces before installing lugs and connectors.

Z. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

AA. Identify and color code wire and cable under provisions of Section 26 0553. Identify each conductor with its circuit number or other designation indicated.

AB. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

AC. This contractor shall derate conductor ampacity in areas of high ambient temperature per the NEC.

3.04 FIELD QUALITY CONTROL

A. Provide all test results to Engineer in Substantial Completion Submittals, via Architect, prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Grounding and bonding components.

1.02 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Field Quality Control Test Reports.

C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.

b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
3. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
4. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4"x4"x18" unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.

H. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
    c. Ground Bar Size: 1/4"x4"x18" unless otherwise indicated or required.
    d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

I. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 5/8 inch (16 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that conditions are satisfactory for installation prior to starting work.

C. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

F. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing . Bond steel together.

G. Equipment Grounding Conductor: Provide separate, insulated copper equipment grounding conductor in all conduits and raceways described below. Terminate each end on suitable lug, bus, or bushing. Where ground conductors are specified or required, conduit sizes shall be increased as necessary to meet the NEC conduit fill requirements.
   1. All new feeders.
   2. All raceways for receptacle circuits, including special power receptacles.
   3. All surface raceway/multi-outlet assemblies containing power receptacles (i.e. wiremold).
   4. All motor feeders and branch circuits.
   5. All flexible metal conduit.
   6. All non-metallic raceways containing power conductors.

H. Provide separate, insulated conductor within all raceways or sections of raceways which contain non-metallic conduit.

I. Provide separate grounding jumper from the grounding screw of all receptacle devices to the metallic box in which device is mounted. Jumper may attach to box with a separate grounding screw or clip device. Jumpers may be eliminated if approved self-grounding devices are used.

J. In general, equipment grounding conductors are not indicated on the plans. Size conductors to comply with NEC requirements.

3.03 FIELD QUALITY CONTROL

A. Provide all test results to Engineer in Substantial Completion Submittals, via Architect, prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 0529 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. MFMA-4 - Metal Framing Standards Publication.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction.

F. NFPA 70 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 2.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, or perforated pipe strap for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 12 inches (_____ mm) under supported component to top of roofing.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

END OF SECTION

SECTION 26 0534 - CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (GRC).

B. Intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride conduit (PVC).

G. Accessories.

H. Conduit, fittings and conduit bodies.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).

B. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT).

E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

F. NFPA 70 - National Electrical Code.

G. UL 6 - Electrical Rigid Metal Conduit-Steel.

H. UL 1242 - Electrical Intermediate Metal Conduit-Steel.

1.03 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior in utility areas or areas with open ceilings: Use electrical metallic tubing (EMT)

K. Exposed, Interior in finished areas: Use metallic surface raceway. Refer to Section 26 0535 for further requirements.
   1. Obtain written verification for installation of this type before proceeding with work, unless specifically noted on plans.

L. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

M. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

N. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.02 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 2100.

B. Communications Systems Conduits: Also comply with Section 27 1005.

C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 1/2 inch (16 mm) trade size.
   2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   3. Control Circuits: 1/2 inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
   5. Underground, Interior: 3/4 inch (21 mm) trade size.
   6. Underground, Exterior: 1 inch (27 mm) trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (GRC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel to match conduit.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use material to match conduit.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use material to match conduit.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use material to match conduit.
   3. Connectors and Couplings: Use set-screw type.
      a. Do not use indenter type connectors and couplings.
      b. Do not use die-cast EMT fittings.
   4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
   5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces are ready to receive conduits.

B. Verify that conditions are satisfactory for installation prior to starting work.

C. Verify routing and termination locations of conduit prior to rough-in.

D. Conduit routing is shown on drawings is in approximate location unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (GRC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:
   1. When conduit destination is indicated without specific routing, determine exact routing required.
   2. Conceal all conduits unless specifically indicated to be exposed.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
         1) Coordinate routing in joist with mechanical duct work to avoid conflicts.
   4. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   5. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   8. Route conduits above water and drain piping where possible.
   9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

10. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
11. Group parallel conduits in the same area together on a common rack.

G. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
8. Use of wire for support of conduits is not permitted.
9. Support conduit using coated steel strap, clevis hanger, split hanger, or lay-in adjustabble hangers.

H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.

9. Install firestopping to preserve fire resistance ratings of partitions and other elements, using materials and methods approved under the fire protection specifications.

J. Underground Installation:
   1. Provide trenching and backfilling in accordance with Section 26 0515.
   2. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 24 inches (610 mm).
      b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
   3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length.

K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where conduits are subject to earth movement by settlement or frost.
   3. Where specifically called out on drawings.

L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

M. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

N. Provide grounding and bonding in accordance with Section 26 0526.

O. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 4000.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

END OF SECTION

SECTION 26 0537 - BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Floor boxes.

D. Underground boxes/enclosures.

E. Wall and ceiling outlet boxes.

F. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding.

B. Section 26 0529 - Hangers and Supports.

C. Section 26 0534 - Conduit:

D. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Additional requirements for locating boxes for wiring devices.

E. Section 27 1005 - Structured Cabling and Equipment for Voice and Data: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NFPA 70 - National Electrical Code.

G. SCTE 77 - Specification for Underground Enclosure Integrity.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for junction and pull boxes, cabinets and enclosures, and floor boxes.

C. Project Record Documents: Record actual locations for junction boxes, pull boxes, and cabinets and enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Keys for Lockable Enclosures: Two of each different key.
      a. Deliver to Owner in accordance with Division 01 instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
   12. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
      b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
      c. Ceiling Outlets: 4 inch octagonal or square by 2-1/8 inch deep (100 by 54 mm) trade size.
   13. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 1, painted steel.
      b. Outdoor Locations: Type 3R, painted steel.
   3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
      b. Back Panels: Painted 3/4 inch fire-retardant plywood.
      c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
   5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
   2. Use cast iron floor boxes within slab on grade.
   3. Use sheet-steel or cast iron floor boxes within slab above grade.
   4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
   5. Manufacturer: Same as manufacturer of floor box service fittings.

E. Underground Boxes/Enclosures:
   1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
   2. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
   3. Applications:
      a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 8 load rating.
      b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 15 load rating.
      c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
   4. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
      a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.02 PULL AND JUNCTION BOXES

A. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

B. Fiberglass Handholes: Die molded glass fiber hand holes:
   1. Cable Entrance: Pre-cut 6 x 6 inch (150 x 150 mm) cable entrance at center bottom of each side.
   2. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify locations of floor boxes and outlets prior to rough-in.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

F. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
      b. Communications Systems Outlets: Comply with Section 27 1005.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0534.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

G. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support, at each corner, from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

H. Install boxes plumb and level.

I. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

J. Install boxes as required to preserve insulation integrity.

K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

L. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
   2. Flush-mount enclosures located in concrete or paved areas.
   3. Mount enclosures located in landscaped areas with top at 1 inch (25 mm) above finished grade.
   4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

O. Close unused box openings.

P. Provide grounding and bonding in accordance with Section 26 0526.

Q. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

R. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.

S. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 5 feet (____ m) if required to accommodate intended purpose.

T. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.

U. Maintain headroom and present neat mechanical appearance.

V. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

W. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

X. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

Y. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

Z. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AA. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

AB. Use adjustable steel channel fasteners for hung ceiling outlet box.

AC. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.

AD. Use gang box where more than one device is mounted together. Do not use sectional box.

AE. Use gang box with plaster ring for single device outlets.

AF. Use cast outlet box in exterior locations exposed to the weather and wet locations.

AG. Identify boxes in accordance with Section 26 0553.

AH. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.03 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

B. Clean electrical parts to remove conductive and harmful materials.

C. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Conductors and Cable: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

C. Section 27 1005 - Structured Cabling and Equipment for Voice and Data: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

D. NFPA 70E - Standard for Electrical Safety in the Workplace.

E. UL 969 - Marking and Labeling Systems.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

1.05 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Designation name from Single Line Diagram.
         2) Identify voltage and phase.
         3) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      b. Time Switches:
         1) Identify load(s) served and associated circuits controlled. Include location.
      c. Enclosed Contactors:
         1) Identify ampere rating.
         2) Identify coil voltage.

3) Identify load(s) and associated circuits controlled. Include location.

2. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
3. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
4. Use identification label or identification nameplate on inside of door at each fused switch to identify required NEMA fuse class and size.
5. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
   a. Service equipment.
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
   2. Identification for Communications Conductors and Cables: Comply with Section 27 1005.
   3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment.
   4. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:
   1. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:
   1. Use color coded boxes to identify specified systems.
      a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
         1) Fire Alarm System: Red.
   2. Use identification labels to identify circuits enclosed.
      a. For exposed boxes in public areas, provide identification on inside face of cover.
      b. Label all junction boxes with Panel Designation, Circuit Number, and Voltage

E. Identification for Devices:
   1. Identification for Communications Devices: Comply with Section 27 1005.
   2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
   3. Use identification label to identify fire alarm system devices.
      a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
   4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
      a. For receptacles in public areas, provide identification on inside surface of wallplate.

5. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
      a. Exception: Provide minimum thickness of 1/8 inch (3 mm) when any dimension is greater than 4 inches (100 mm).
   3. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   4. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
      a. Use only for indoor locations.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
   2. Legend:
      a. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. Equipment Designation: 1/2 inch (13 mm).
      b. Other Information: 1/4 inch (6 mm).
   5. Color:
      a. Normal Power System: White text on black background.
      b. Fire Alarm System: Black text on red background.

D. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch (5 mm).
   5. Color: Black text on clear background.

E. Format for Control Device Identification:
   1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
   2. Legend: Load controlled or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch (5 mm).
   5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).

F. Color: Black text on white background unless otherwise indicated.

G. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Identify feeder and branch circuit conductors using the following colors:
      a. 208/120V system: Phase A - black, phase B - red, phase C - blue, neutral - white, equipment ground - green, switch leg - purple.
      b. Wire #6 AWG and smaller shall be factory color-coded. Wire No. 4 AWG and larger may be factory color-coded, or field coded by taping a minimum 6 inch length of each exposed conductor end with colored tape.
   3. Communications Cables: Provide with indelible, permanent identification labels on both ends. Coordinate with owner personnel to verify proper identification schemes. In lieu of owner provided communications, or signal identification schemes, EC to provide labeling per TIA/EIA 606 standards for cabling at each cable end and all termination points.

2.04 CONDUIT MARKERS

A. Minimum Size:

B. Legend:

C. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. Lighting contactors.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding.

B. Section 26 0529 - Hangers and Supports.

C. Section 26 0537 - Boxes.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

E. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

F. NFPA 70 - National Electrical Code.

G. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules.

H. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each of the following items; Timeclock and Lighting Contactor.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Field Quality Control Reports.

D. Operation and Maintenance Data: Include detailed information on device programming and setup.

E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 WARRANTY

A. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Building Automation, Inc: www.hubbellautomation.com
   2. WattStopper: www.wattstopper.com.
   3. Acceptable equal..

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   8. Sensitivity: Field adjustable.
   9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.

C. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.

c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
e. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.

2.03 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc; : www.intermatic.com.
2. Tork, a division of NSI Industries LLC; : www.tork.com.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
a. Astronomic Time Switches: Two Circuit, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: As indicated on the drawings.
8. Output Switch Configuration: As required to control the load indicated on the drawings.
9. Output Switch Contact Ratings: As required to control the load indicated on the drawings.

2.04 LIGHTING CONTACTORS

A. Manufacturers:
1. General Electric Company: www.geindustrial.com.
2. Rockwell Automation Inc; Allen-Bradley Products; _____: ab.rockwellautomation.com.
3. Schneider Electric; Square D Products: www.schneider-electric.us.

B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C. Short Circuit Current Rating:
1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Enclosures:

1. Comply with NEMA ICS 6.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
3. Finish: Manufacturer's standard unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that final surface finishes are complete, including painting.

B. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

C. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches (1.2 m) above finished floor.
   2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Provide required supports in accordance with Section 26 0529.

G. Identify lighting control devices in accordance with Section 26 0553.

H. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

I. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 0537 for mounting of lighting control device system components.

3.03 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Test time switches to verify proper operation.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Owner. Record settings in written report to be included with submittals.

3.05 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   3. Location: At project site.

END OF SECTION

SECTION 26 2100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding.

B. Section 26 0529 - Hangers and Supports.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NFPA 70 - National Electrical Code.

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: Powder River Energy.

D. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Vaults and Pads: Furnished and installed by the Utility Company..
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
      d. Primary:
         1) Trenching and Backfilling: Provided by Utility Company.
         2) Conduits: Furnished and installed by the Utility Company..
         3) Conductors: Furnished and installed by Utility Company.
      e. Secondary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Contractor (Service Point at transformer).
   2. Terminations at Service Point: Provided by Utility Company.
   3. Metering Provisions:
      a. Meter Bases: Furnished and installed by the Utility Company..
      b. Metering Transformer Cabinets: Furnished and installed by the Utility Company..
      c. Metering Compartments in Service Entrance Equipment: Furnished and installed by the Utility Company..
      d. Metering Transformers: Furnished and installed by Utility Company.
      e. Conduits Between Metering Transformers and Meters: Furnished and installed by the Utility Company..
      f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment components in accordance with Section 26 0529.

E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.

F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.03 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 407 - Standard for Installing and Maintaining Panelboards.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NEMA PB 1 - Panelboards.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

F. NFPA 70 - National Electrical Code.

G. UL 67 - Panelboards.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

I. UL 943 - Ground-Fault Circuit-Interrupters.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. Siemens Industry, Inc: www.usa.siemens.com.

C. Square D: www.schneider-electric.com

D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
   3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

K. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:
1. Provide bolt-on type.
2. Molded Case Circuit Breakers with integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR

E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.

E. Enclosures:
1. Provide surface-mounted enclosures as indicated.

2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated on drawings
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Provide grounding and bonding in accordance with Section 26 0526.
1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

J. Install all field-installed branch devices, components, and accessories.

K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

M. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

N. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Fire detection and alarm circuits.
   2. Communications equipment circuits.
   3. Intrusion detection and access control system circuits.
   4. Video surveillance system circuits.

Q. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.
   1. Description included on electrical panel schedules are for design purposes only. Description printed on final panel schedules must have a sufficient degree of detail that allows each circuit to be distinguished from all others, as approved by the Authority Holding Jurisdiction.

R. Provide identification nameplate for each panelboard in accordance with Section 26 0553.

S. Provide arc flash warning labels in accordance with NFPA 70.

T. Provide floor markings to clearly indicate required working clearances where indicated or where required by the authority having jurisdiction.

3.02 FIELD QUALITY CONTROL

A. Provide all test results to Engineer in Substantial Completion Submittals, via Architect, prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed.

B. Test GFCI circuit breakers to verify proper operation.

C. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 2717 - EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices.

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

C. NFPA 70 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 2818 and in individual equipment sections.

C. Disconnect Switches: As specified in Section 26 2818.

D. Wiring Devices: As specified in Section 26 2726.

E. Flexible Conduit: As specified in Section 26 0534.

F. Wire and Cable: As specified in Section 26 0519.

G. Boxes: As specified in Section 26 0537.

H. Motor Controllers: As specified in Section 26 2913.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 EQUIPMENT CONNECTIONS

A. Furnish and install all wiring except temperature control wiring, equipment control wiring which does not conduct full load motor current, and interlock wiring, unless indicated otherwise. Furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters.

B. Furnish and install conduit for all wiring, including temperature control wiring, equipment control wiring, interlock wiring.

C. Unless otherwise indicated, all hvac and plumbing equipment motors and controls shall be furnished, set in place, and wired in accordance with the following schedules:

	Furnished By	Installed By	Power Wired By	Control Wired By
Equipment motors	MC	MC	EC	-
Magnetic motor starters, manual or auto control w/ or w/o hand-off-auto	EC	EC	EC	MC
Magnetic motor starters supplied as part of factory wired equipment	MC	MC	EC	MC
Combination magnetic motor starter disconnects	EC	EC	EC	MC
Disconnect switches and thermal overload switches	EC	EC	EC	-
Pushbuttons and pilot lights:				
a. Full load motor amps	MC	EC	EC	EC
b. Non-full load motor amps	MC	MC	-	MC
Temperature control relays and transformers	MC	MC	EC	MC
Thermostats and time clocks:				
a. Full load motor amps	MC	EC	EC	EC
b. Non-full load motor amps	MC	MC	-	MC
Temperature control panels and time clocks mounted within panels	MC	MC	EC	MC
Motorized valves, damper motors and remote bulb thermostats	MC	MC	EC	MC
Solenoid valves, PE switches, EP switches, etc.	MC	MC	EC	MC
Smoke detectors and relays for fan shutdown:				
a. Bldg w/ fire alarm system	EC	EC	EC	EC

b. Bldg w/o fire alarm system	MC	MC	MC	MC

D. For equipment furnished by Mechanical Contractor, EC to install all VFD's, starters and disconnects not factory mounted on equipment. The Mechanical Contractor shall provide and be responsible for the overload "heaters" in all starters furnished under Divisions 22 and 23.

E. Control relay and control transformers shall be furnished under the mechanical contract except where furnishing such items is specifically required under the electrical specifications and/or drawings.

F. Provide field-installed disconnect switch when not in direct sight of Panelboard, Loadcenter, or Motor Controller.

3.03 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

I. Provide hardwired electrical connections using flexible conduit.

J. For Cord and Plug electrical connections, provide GFI protected receptacle with proper configuration to match equipment plug.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

D. Floor box service fittings.

1.02 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

E. NEMA WD 1 - General Color Requirements for Wiring Devices.

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

G. NFPA 70 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Field Quality Control Test Reports.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 WIRING DEVICE FINISHES

A. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

B. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

C. Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.

D. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

E. Flush Floor Box Service Fittings: Gray wiring devices with brass cover and ring/flange.

2.04 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc; IP710-LFZ: www.leviton.com.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
   1. Match Load shown on drawings; 1200W minimum

E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.06 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. All GFI Receptacles: Provide with light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
   2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
      a. Products:
         1) Pass & Seymour "PlugTail" Extra Heavy-Duty Specification Grade Receptacles # PT-2095 with PTRA6 PlugTails or pre-approved equal.
   3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.07 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.08 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Wiremold, a brand of Legrand North America, Inc: www.legrand.us

B. Description: Service fittings compatible with floor boxes provided under Section 26 0537 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
   1. Single Service Flush Convenience Receptacles:
      a. Cover: Rectangular.
      b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches (1200 mm) above finished floor.
      b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
      c. Receptacles: 18 Inches above finished floor or 6 inches (150 mm) above counter, or 2" above backsplash.
      d. Install Individual Telephone or Data outlet 18 Inches above finished floor.
      e. Install Combo Tele/Data outlet 18 Inches above finished floor.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Connect wiring device grounding terminal to outlet box with bonding jumper.

Q. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

R. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

S. Use jumbo size plates for outlets installed in masonry walls.

T. Install protective rings on active flush cover service fittings.

U. For all dedicated EWC receptacle, EC to rough-in behind water cooler shroud so no cords or plugs are visible when shroud is installed.

3.04 FIELD QUALITY CONTROL

A. Provide all test results to Engineer in Substantial Completion Submittals, via Architect, prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch with circuit energized to verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle to verify operation and proper polarity.

F. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 26 2416 - Panelboards: Fusible switches.

B. Section 26 2818 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses.

B. NFPA 70 - National Electrical Code.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements.

D. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 26 2818.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fuses: One set(s) of three for each type and size installed.
   2. Fuse Pullers: One set(s) compatible with each type and size installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.

B. Littelfuse, Inc: www.littelfuse.com.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2816 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding.

B. Section 26 0529 - Hangers and Supports.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

D. NFPA 70 - National Electrical Code.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

G. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Electric Company: www.geindustrial.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us.

C. Siemens Industry, Inc: www.usa.siemens.com.

D. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).

2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

H. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.

J. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Copper, suitable for terminating copper conductors only.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

E. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

F. Provide the following features and accessories where indicated or where required to complete installation:
   1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

B. Test shunt trips to verify proper operation.

C. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

END OF SECTION

SECTION 26 2818 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.
   1. Fusible switches.
   2. Nonfusible switches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

D. NFPA 70 - National Electrical Code.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

G. UL 869A - Reference Standard for Service Equipment.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Field Quality Control Test Reports.

E. Project Record Documents: Record actual locations of enclosed switches.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 26 2813 for requirements for spare fuses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Siemens Industry, Inc: www.usa.siemens.com.

D. Square D.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Suitable for operation at 6,000 feet.
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Copper, suitable for terminating copper conductors only.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

P. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Integral fuse pullers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Provide identification nameplate for each enclosed switch in accordance with Section 26 0553.

K. Provide identification label on inside door of each fused switch indicating NEMA fuse class and size installed in accordance with Section 26 0553.

L. Provide arc flash warning labels in accordance with NFPA 70.

M. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

A. Provide all test results to Engineer in Substantial Completion Submittals, via Architect, prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
   1. Manual motor starters.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

F. NFPA 70 - National Electrical Code.

G. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules.

H. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
   3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
   4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   6. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Project Record Documents: Record actual installed locations of controllers and final equipment settings.

D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

E. See Section 26 0010 - General Electrical Requirements for submittal procedures.

F. Field Quality Control Test Reports.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Rockwell Automation, Inc.; Allen-Bradley Products: ab.rockwellautomation.com.

D. Siemens: www.sea.siemens.com.

E. Square D: www.schneider-electric.com.

2.02 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
   1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
      b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
   2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 12.
      b. Outdoor Locations: Type 3R or Type 4.
   3. Finish: Manufacturer's standard unless otherwise indicated.

H. Manual Motor Starters:
   1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
   2. Configuration: Non-reversing unless otherwise indicated.
   3. Fractional-Horsepower Manual Motor Starters:
      a. Furnish with toggle operator.
      b. Overload Relays: Bimetallic or melting alloy thermal type.
      c. Provide means for locking operator in the OFF position.
      d. Furnish Red ON indicating light where not within sight of equipment.

I. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
   1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
   2. Trip-free operation.
   3. Visible trip indication.
   4. Resettable.

a. Employ manual reset unless otherwise indicated.
b. Do not employ automatic reset with two-wire control.

5. Bimetallic Thermal Overload Relays:
   a. Interchangeable current elements/heaters.
   b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
   c. Trip test function.
6. Melting Alloy Thermal Overload Relays:
   a. Interchangeable current elements/heaters.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment components in accordance with Section 26 0529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 26 0526.

G. Install all field-installed devices, components, and accessories.

H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

I. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

J. Identify enclosed controllers in accordance with Section 26 0553.

K. Provide identification nameplate for each panelboard in accordance with Section 26 0553.

L. Provide neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder

M. Provide arc flash warning labels in accordance with NFPA 70.

N. Where a remote disconnect is on the load side of a variable speed/frequency motor drive, ec to provide auxilary contacts with break sensing to signal drive to switch to coast-to-stop mode. Control wiring and programming provided by supplier of drive.

3.02 FIELD QUALITY CONTROL

A. Provide all test results to Engineer in Substantial Completion Submittals, via Architect, prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed.

B. Perform applicable inspections and tests listed in NETA STD ATS, except Section 4

C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

D. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

END OF SECTION

SECTION 26 4300 - SURGE PROTECTION DEVICE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes transient voltage surge suppression for low-voltage power (less than 600 volts) equipment.
   1. Main distribution panelboard.
   2. Scheduled branch panelboards.

1.02 REFERENCES

A. ANSI/IEEE C62.41 and C62.45;

B. Underwriters Laboratories (UL 1449 Third Edition and 1283).

C. NFPA 70 - National Electrical Code; National Fire Protection Association.

D. Independent 3rd party testing.

1.03 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide product data for each type of product indicated. Include operating voltage, rated capacities, I-nominal rating (I-n), Type 1 device listing, Short Circuit Current Rating (SCCR), Voltage Protection Rating (VPR) for all modes, Maximum Continuous Operating Voltage rating (MCOV), operating temperature, shipping, and installed weights.

C. Shop Drawings: Indicate product layout, dimensions, connection requirements, mounting provisions, etc.

D. Test Reports: Provide certified test reports of factory burn in tests.

E. Product Certifications: Provide written Certification that the products submitted meet or exceed specified requirements or written documentation of any specified requirements which the submitted product does not meet.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Obtain suppression devices from a single manufacturer..

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Electrical components, devices, and accessories listed and labeled as defined in NFPA 70, by a testing agency acceptable to AHJ, and marked for intended use.

D. Products Requiring Electrical Connection: Listed and classified by UL 1449 3rd edition and suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Placing into service: Do not energize or connect service entrance equipment or panelboards to their sources until the surge protective devices are installed and connected. Do not single phase, hi-pot, or megger the equipment without disconnecting the surge protection devices.

1.06 PROJECT CONDITIONS

A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
   1. Maximum continuous Operating Voltage: Not less than 125% of nominal system operating voltage for 120/240 Single Phase or 120/208 VAC Three Phase WYE systems, Not less than 115% for 277/480 VAC Three Phase WYE or 480 VAC DELTA systems.
   2. Operating temperature: -40 to +185 degrees F (-40 to 85 degrees C).
   3. Humidity: 0 - 95%, noncondensing.
   4. Altitude: 6000 feet above sea level.

1.07 WARRANTY

A. General warranty: Special warranty specified in this article shall not deprive Owner other rights specified in other provisions of the contract documents and shall be in addition to, and run concurrent with, other warranties made by the contractor under requirements of the Contract Documents.

B. Special warranty: The manufacturer shall provide a five year parts and on-site labor warranty and ten years parts warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48-hour assessment. Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppression devices that fail in materials or workmanship within ten years, from date of substantial completion or 126 months for date of manufacturer.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Manufacturer: Subject to compliance with requirements of this specification listed herein, provide products by one of the following manufacturers:
   1. Leibert
   2. Acceptable Equal

B. Physical:
   1. Enclosure: The specified system shall be provided in a heavy duty NEMA 4 dust-tight, drip-tight enclosure with no ventilation openings.
      a. Electrical:
         1) Unit shall be UL1449, 3rd Edition Listed. A SPD that is a UL “Recognized” component will not be accepted.
         2) SPD shall be UL Labeled as Type 1 (verifiable at UL.com).
         3) SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
         4) SPD shall have a short-circuit rating of 200kAIC. Devices that accomplish this rating by requiring or providing additional fusing to the SPD system will not be accepted.
         5) Unit shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status and operational integrity of the unit.
         6) Unit Operating Voltage. The nominal unit operating voltage and configuration shall be as indicated on the drawings.
         7) Maximum Continuous Operating Voltage (MCOV). The MCOV shall be greater than 115% of nominal voltage for all products.
         8) Operating frequency range shall be 47-63 Hertz.
            (a) Overcurrent Protection:
            (b) Each suppression element shall be individually fused such that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode, or product, deficient by more than 5%. Fusing shall be present in all modes, including Neutral-to-Ground. The device shall be capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent / fault current protection or fuses.

2.02 SERVICE ENTRANCE SWITCHBOARD (800 AMPERES AND LARGER)

A. General
   1. Acceptable Products shall be:
      a. Liebert #560 Series.
   2. Performance

a. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than 160,000 Amps per mode, based on ANSI/IEEE C62.41.
b. Tested Single Pulse Surge Current Capacity. Suppression filter systems shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL1449 3rd Edition surge defined as a 1.2X50 microsec, 6000V open circuit voltage waveform and an 8X20 microsec, 3000A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an 8X20 microsec waveform.
c. Minimum Life Cycle Rating. Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45, Test suppression filter systems in every mode. Tested life under these conditions shall be no less than 15,000 impulses per mode.
d. UL1449 3rd edition Voltage Protection Rating (VPR). All suppression filter system clamping voltages shall be in compliance and listed by UL1449.

2.03 DISTRIBUTION PANEL (400 AMPERES TO 600 AMPERES)

A. General
1. Acceptable Products shall be:
a. Liebert #510 Series

B. Performance
1. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than 160,000 Amps per mode.
2. Tested Single Pulse Surge Current Capacity. Suppression filter systems shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL1449 Second Edition surge defined as a 1.2X50 sec, 6000V open circuit voltage waveform and an 8X20 sec, 500A short circuit current waveform to benchmark the unit’s suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an 8X20 sec waveform..
3. Minimum Life Cycle Rating. Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-1992, Test suppression filter systems in every mode. Tested life under these conditions shall be no less than 8,000 impulses per mode.
4. UL1449 3rd edition Voltage Protection Rating (VPR). All suppression filter system clamping voltages shall be in compliance and listed by UL1449.

2.04 BRANCH PANELS (100 AMPERES TO 400 AMPERES)

A. General
1. Acceptable Products shall be:
a. Liebert #510 Series.

B. Performance
1. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than 130,000 Amps per mode.
2. Tested Single Pulse Surge Current Capacity. Suppression filter systems shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 sec, 6000V open circuit voltage waveform and an 8X20 sec, 500A short circuit current waveform to benchmark the unit’s suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an 8X20 sec waveform.
3. Minimum Life Cycle Rating. Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-1992, Test suppression filter systems in every mode. Tested life under these conditions shall be no less than 6,000 impulses per mode.

4. UL1449 3rd edition Voltage Protection Rating (VPR). All suppression filter system clamping voltages shall be in compliance and listed by UL1449.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install devices at distribution panelboards and branch panelboards as indicated on the drawings.

B. Provide multi-pole breakers as specified by manufacturers as dedicated disconnects for TVSS devices that do not have an integral disconnect. Indicate breakers on submittals and as-built drawings.

C. Locate surge suppression panels adjacent to the switchboards and panelboards to limit the feeder to a maximum of 18". Locate the overcurrent device to the nearest location.

D. Use only stranded THHN wire for TVSS leads or lead extensions.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with manufacturer's written instructions.

3.03 STARTING EQUIPMENT AND SYSTEMS

A. Demonstrate proper operation of equipment to owner's designated representative.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

D. Lamps.

1.02 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

B. Section 26 0919 - Enclosed Contactors: Lighting contactors.

C. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

D. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

B. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems.

F. NFPA 70 - National Electrical Code.

G. NFPA 101 - Life Safety Code.

H. UL 924 - Emergency Lighting and Power Equipment.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
    a. Include estimated useful life, calculated based on IES LM-80 test data.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
3. Extra Ballasts/Drivers: Two percent of total quantity installed for each type, but not less than one of each type.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

B. Provide five year pro-rata warranty for batteries for emergency lighting units.

C. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS - LUMINAIRES

A. As scheduled.

B. Acceptable equal. See Division 01 for substitution procedures.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. See Section 26 0010 - General Electrical Requirements for submittal procedures.

2.03 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

2.04 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.05 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

B. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   3. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.06 BALLASTS AND DRIVERS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com.
   2. Osram Sylvania: www.sylvania.com.
   3. Philips Lighting Electronics/Advance: www.advance.philips.com.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.07 LAMPS

A. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

B. LED:
   1. Light Loss: L70 equal to or greater than 50,000 hrs.
   2. Color Shift within a 3-step ellipse.
   3. Luminaire performance based on 25 degree ambient temperature.
   4. Power Factor greater .85 or better.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
   4. Install canopies tight to mounting surface.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

K. Surface Mounted Fixtures: Install plumb and square and aligned with building lines and with each other; secure to prevent movement.

L. Wall Mounted Fixtures: Install at height as indicated on the drawings.

M. Locate recessed ceiling luminaires as indicated on lighting plans.

N. Install accessories furnished with each luminaire.

O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture.

P. Bond products and metal accessories to branch circuit equipment grounding conductor.

Q. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

R. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

S. Install lamps in each luminaire.

3.02 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.03 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Owner. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

D. Aim and adjust fixtures as indicated.

3.04 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean finishes and touch up damage.

3.05 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed.

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. Poles and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0526 - Grounding and Bonding.

C. Section 26 0537 - Boxes.

D. Section 26 0919 - Enclosed Contactors: Lighting contactors.

E. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.

F. Section 26 5013 - Luminaire Schedule.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems.

F. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.

G. NFPA 70 - National Electrical Code.

H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
3. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.

D. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the Drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 BALLASTS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

2.04 LAMPS

A. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

B. LED:
   1. Light Loss: L70 equal to or greater than 50,000 hrs.
   2. Color temperature of 4,000k.

3. Color Shift within a 3-step ellipse.
4. Luminaire performance based on 25 degree ambient temperature.

2.05 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
         1) Design Wind Speed: 100 miles per hour (_____ kph), with gust factor of 1.3..
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Square straight, unless otherwise indicated.
   5. Finish: Match luminaire finish, unless otherwise indicated.
   6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   7. Unless otherwise indicated, provide with the following features/accessories:
      a. Top cap.
      b. Handhole.
      c. Anchor bolts with leveling nuts or leveling shims.
      d. Anchor base cover.

B. Metal Poles: Provide ground lug, accessible from handhole.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

G. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      a. Comply with IEEE C2.
      b. Comply with utility company requirements.
   2. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.
      b. Install foundations plumb.
      c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      d. Tighten anchor bolt nuts to manufacturer's recommended torque.
      e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
      f. Install anchor base covers or anchor bolt covers as indicated.
   3. Grounding:
      a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install lamps in each luminaire.

3.02 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect/Architect.

3.03 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.04 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

3.05 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed.

END OF SECTION

DIVISION

27

COMMUNICATIONS

SECTION 27 1005 - STRUCTURED CABLING AND EQUIPMENT FOR VOICE AND DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications pathways.

B. Copper cable and terminations.

C. Communications equipment room fittings.

D. Communications outlets.

E. Communications grounding and bonding.

F. Communications identification.

G. Telecommunications service entrance to building(s).

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding.

B. Section 26 0534 - Conduit.

C. Section 26 0536 - Cable Trays for Electrical Systems.

D. Section 26 0537 - Boxes.

E. Section 26 2726 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Alliance/Electrical Components Association.

B. EIA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Association; Revision D, 1992.

C. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association.

D. NFPA 70 - National Electrical Code.

E. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set.

F. TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements.

G. TIA-568-C.3 - Optical Fiber Cabling Components Standard.

H. TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces.

I. TIA-606-B - Administration Standard for the Telecommunications Infrastructure.

J. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

K. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.

M. UL 1863 - Communications-Circuit Accessories.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used (Cables, Racks, Switches, Outlets, etc.).
   1. Storage and handling requirements and recommendations.
   2. Installation methods.

C. Field Test Reports.

D. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Supervisors and installers factory certified by manufacturers of products to be installed.
   2. Employing experienced technicians for all work; show at least 3 years experience in the installation of the type of system specified, with evidence from at least 2 projects that have been in use for at least 18 months; submit project name, address, and written certification by user.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Keep stored products clean and dry.

1.08 WARRANTY

A. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cabling:
   1. Belden
   2. Westpenn. www.westpenn-wpw.com/
   3. Avaya. www.avaya.com/
   4. General Cable. www.generalcable.com/
   5. Acceptable Equal

B. Equipment:
   1. Panduit. www.panduit.com/
   2. Systimax. www.commscope.com/
   3. Cisco. www.cisco.com/
   4. Acceptable Equal

2.02 SYSTEM DESIGN

A. Provide a complete, permanent system of cabling and pathways for voice and data communications, including conduits and wireways, pull wires, support structures, enclosures and cabinets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569-C (pathways), latest editions (commercial standards).
   2. Provide fixed conduits and pathways that comply with NFPA 70 and ANSI/J-STD-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.
   4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

5. Provide a separate cable for every jack indicted, both in single and multiple jack outlet combinations.

B. System Description:
   1. Building Entrance Cable: By others.
   2. Horizontal Cabling: Copper.
   3. Provide additional outlets where indicated on drawings.

C. Main Distribution Frame (MDF): Centrally located support structure for terminating backbone cables and horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
   1. Locate main distribution frame as indicated on the drawings..
   2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.03 PATHWAYS

A. Conduit: As specified in Section 26 05 34.
   1. Provide pull cords in all empty conduit

B. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.

2.04 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568 Category 6 UTP (unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
      b. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
   5. Cable Jacket Color - Voice and Data Cable: Blue.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 750 mating cycles.
   2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

D. Copper Patch Cords:
   1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
   2. Patch Cords for Patch Panels:
      a. Quantity: One for each pair of patch panel ports.
      b. Length: 4 feet (6 mm).

2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
   1. Connector Blocks for Category 6 Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
   2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.

a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.
d. Provide incoming cable strain relief and routing guides on back of panel.

B. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.
1. Size: 48 by 96 inches (1220 by 2440 mm).
2. Do not paint over UL label.

C. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch (482.6 mm) wide component racks.

D. Equipment Racks and Cabinets:
1. Wall Mounted Racks: Steel construction, hinged to allow access to back of installed components.

2.06 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 0537.
1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
2. Minimum Size, Unless Otherwise Indicated:
a. Voice Only Outlets: 4 inch by 2 inch by 2-1/8 inch deep (100 by 50 by 54 mm) trade size.
b. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.

B. Wall Plates:
1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726.

2.07 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607-B.

2.08 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569-C (pathways), TIA-607-B (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607-B and NFPA 70.

3.02 INSTALLATION OF PATHWAYS

A. Underground Service Entrance: Install conduit at least 24 inches (___ mm) below finish grade; encase in at least 3 inches (75 mm) thick concrete for at least 60 inches (1500 mm) out from the building line. Provide foil backed warning tape in trench from building line to utility pedestal.

B. Install pathways with the following minimum clearances:
1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches (300 mm) from power conduits and cables and panelboards.
3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.

4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

C. Conduit:
   1. Provide conduit in all inaccessible areas, crawlspaces, walls, and where exposed to view unless indicated below.
      a. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
      b. Leave pull cords in place where cables are not initially installed.
      c. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
         1) Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
         2) Treat conduit in crawl spaces and under floor slabs as if exposed to view.
         3) Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
         4) Under floor slabs, locate conduit at 12 inches (300 mm), minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

D. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of telecommunications outlets provided under this section.
      a. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 60 inches (____ mm).
   2. At Outlets - Copper: 12 inches (305 mm).

C. Copper Cabling:
   1. Category 5e/6/6A: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
   3. Use T568B wiring configuration.
   4. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.
   5. For all cable, provide NFPA 70 type CMP plenum-rated cable.

D. Wall-Mounted Racks and Enclosures:
   1. Install to plywood backboards only, unless otherwise indicated.
   2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.

E. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
   1. Cables: Install color coded labels on both ends.
   2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.
   3. Patch Panels: Label each jack as to its type and function, with a unique numerical identifier.

F. Install all equipment listed above in racks at locations coordinated by owner IT representative.

3.04 FIELD QUALITY CONTROL

A. EC to provide all testing. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.

C. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Test operation of shorting bars in connection blocks.
   4. Category 6 Backbone: Perform near end cross talk (NEXT) and attenuation tests.
   5. Category 6 Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

D. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.
   1. Provide a copy of the copper cabling certification to with the O&M manuals.

END OF SECTION

DIVISION

28

ELECTRONIC SAFETY AND SECURITY

SECTION 28 3105 - FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes fire alarm systems.

1.02 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.03 SYSTEM DESCRIPTION

A. Intelligent, addressable system; multiplexed signal transmission dedicated to fire alarm service only.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72.

B. Fire alarm signal shall initiate the following actions:
   1. Alarm notification appliances shall operate continuously.
   2. Identify alarm at the FACP and remote annunciators.
   3. De-energize electromagnetic door holders.
   4. Transmit an alarm signal to the remote alarm receiving station.
   5. Release fire and smoke doors held open by magnetic door holders.
   6. Activate voice/alarm communication system.
   7. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
   8. Record events in the system memory.

C. System trouble signal initiation shall be by one or more of the following devices or actions:
   1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
   2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
   3. Loss of primary power at the FACP.
   4. Ground or a single break in FACP internal circuits.
   5. Abnormal ac voltage at the FACP.
   6. A break in standby battery circuitry.
   7. Failure of battery charging.
   8. Abnormal position of any switch at the FACP or annunciator.

1.05 SUBMITTALS

A. See Section 26 0010 - General Electrical Requirements for submittal procedures.

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

C. Shop Drawings:
   1. Shop Drawings shall be prepared by persons with the following qualifications:
      a. Trained and certified by manufacturer in fire alarm system design.
   2. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
   3. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
   4. Batteries: Size calculations.
   5. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   6. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. FACP and Equipment:
      a. Edwards Systems Technology Inc.
      b. NOTIFIER; a GE-Honeywell Company.
      c. Gamewell/FCI
      d. Fire Lite Alarms
   2. Wire and Cable:
   3. Audible and Visual Signals:
      a. Gentex Corporation.
      b. System Sensor; a GE-Honeywell Company.

2.02 FACP

A. General Description:
   1. Modular, power-limited design with electronic modules, UL 864 listed.
   2. Addressable initiation devices that communicate device identity and status.
   3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
   1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
   2. Keypad: Arranged to permit entry and execution of programming, display, and control commands; and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:
   1. Signaling Line Circuits: NFPA 72, Class B.
   2. Notification-Appliance Circuits: NFPA 72, Class B.

D. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.

E. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.
   1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
   2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
   3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.
   1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
   2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."

I. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
   1. Batteries: Sealed lead calcium.
   2. Battery and Charger Capacity: Comply with NFPA 72.

J. Surge Protection:
   1. Install surge protection on normal ac power for the FACP and its accessories.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Dry-pipe sprinkler system pressure.
   3. Dry-pipe sprinkler valve room low temperature.
   4. Fire pump(s).
   5. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   3. Duct smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
   3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Combination Smoke/Fire Dampers: Install smoke detector per IMC to close damper.
   2. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.

2.04 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.05 SYSTEM SMOKE DETECTORS

A. General Description:
   1. UL 268 listed, operating at 24-V dc, nominal.
   2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

B. Photoelectric Smoke Detectors:
   1. Sensor: LED or infrared light source with matching silicon-cell receiver.
   2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:
   1. Photoelectric Smoke Detectors:
      a. Sensor: LED or infrared light source with matching silicon-cell receiver.
      b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
   2. UL 268A listed, operating at 24-V dc, nominal.
   3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   4. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
   5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where indicated.
   6. Each sensor shall have multiple levels of detection sensitivity.
   7. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
   8. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.06 NOTIFICATION APPLIANCES

A. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.

B. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
   1. Rated Light Output: Noted on drawings.

2.07 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
   1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
   2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
   3. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.08 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a

signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.09 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
   1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.
   3. Multiconductor Armored Cable: NFPA 70 Type MC, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Smoke or Heat Detector Spacing:
   1. Smooth ceiling spacing shall not exceed the rating of the detector.

B. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

D. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

F. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

3.02 WIRING INSTALLATION

A. Install wiring according to the following:
   1. NECA 1.
   2. TIA/EIA 568-A.

B. Wiring Method:
   1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
   2. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring

diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.04 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
   2. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
   3. Testing: Follow procedure and record results complying with requirements in NFPA 72.
      a. Detectors that are outside their marked sensitivity range shall be replaced.
   4. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.06 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.

1. Record all system operations and malfunctions.
2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
3. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.07 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. All aspects of operation have been demonstrated to Owner.
   3. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   4. Occupancy permit has been granted.

END OF SECTION

DIVISION

31

EARTHWORK

SECTION 31 1000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

D. Section 02 4100 - Demolition: Removal of built elements and utilities.

E. Section 31 2200 - Grading: Topsoil removal.

F. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 7000.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

E. Protect neighboring properties and their utilities.

3.03 VEGETATION

A. Do not remove or damage vegetation beyond the limits indicated on drawings.
   1. Repair damage to neighboring properties affected by demolition and construction activities.

B. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

C. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.

D. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 2200

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal and storage of topsoil.

B. Rough grading the site for site structures.

C. Finish grading.

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching: Trenching and backfilling for utilities.

D. Section 31 2323 - Fill: Filling and compaction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 2323 for filling procedures.

G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil in areas where seeding and sodding are indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

3.06 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.07 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 2316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: General requirements for dewatering of excavations and water control.

B. Section 02 4100 - Demolition: Shoring and underpinning.

C. Section 31 2200 - Grading: Grading.

D. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

E. Section 31 2323 - Fill: Fill materials, filling, and compacting.

1.03 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

2.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 2200 for additional requirements.

C. Locate, identify, and protect utilities that remain and protect from damage.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect plants, lawns, and other features to remain.

2.03 EXCAVATING

A. Underpin adjacent structures that could be damaged by excavating work.

B. Excavate to accommodate new structures and construction operations.

C. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

E. Do not interfere with 45 degree bearing splay of foundations.

F. Cut utility trenches wide enough to allow inspection of installed utilities.

G. Hand trim excavations. Remove loose matter.

H. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

I. Grade top perimeter of excavation to prevent surface water from draining into excavation.

J. Remove excavated material that is unsuitable for re-use from site.

K. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

L. Remove excess excavated material from site.

2.04 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 2316.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Site grading.

B. Section 31 2316 - Excavation: Building and foundation excavating.

C. Section 31 2323 - Fill: Backfilling at building and foundations.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

F. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. All Fill Types: On-site excavated material to be used for fill unless noted otherwise on the drawings.

B. Topsoil: See Section 31 2200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 2200 for additional requirements.

C. Locate, identify, and protect utilities that remain and protect from damage.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect plants, lawns, rock outcroppings, and other features to remain.

3.03 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove excavated material that is unsuitable for re-use from site.

H. Stockpile excavated material to be re-used in area designated in Section 31 2200.

I. Remove excess excavated material from site.

3.04 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

G. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

H. Reshape and re-compact fills subjected to vehicular traffic.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.07 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 31 2323

FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling and compacting for building volume below grade, footings, slabs-on-grade, paving, and site structures.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 31 2200 - Grading: Site grading.

C. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

D. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

F. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.05 QUALITY ASSURANCE

A. Owner to provide Testing Agency. Contractor to call for tests from testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where necessary.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. All Fill Types: Use on site materials.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

G. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

H. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

I. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.05 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

DIVISION

32

EXTERIOR IMPROVEMENTS

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks, stair steps, integral curbs, and gutters.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 07 9200 - Joint Sealants: Sealing joints.

C. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

D. Section 31 2323 - Fill: Compacted subbase for paving.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

D. ACI 305R - Hot Weather Concreting; 2010.

E. ACI 306R - Cold Weather Concreting; 2010.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

H. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

I. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

K. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

L. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

M. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

A. Comply with applicable requirements of ACI 301.

B. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, natural color Portland cement, exposed aggregate finish.

2.02 FORM MATERIALS

A. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
   1. Thickness: 1/2 inch.

2.03 REINFORCEMENT

A. Use fibermesh reinforcement on all exterior pavements.

2.04 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: As specified in Section 03 3000.

C. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.

2.05 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, Class A.

2.06 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

C. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

2.07 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. Prepare subbase in accordance with Municipality of Sundance Public Works standards.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.06 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Do not place concrete when base surface is wet.

C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints.

E. Place concrete to pattern indicated.

F. Apply surface retarder to all exposed surfaces in accordance with manufacturer's instructions.

3.07 JOINTS

A. Align curb, gutter, and sidewalk joints.

B. Place 1/2 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components.
   1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
   2. Secure to resist movement by wet concrete.

C. Provide tooled joints.
   1. At 5 feet intervals in sidewalks as indicated on the drawings.

3.08 FINISHING

A. Sidwalk Paving: Light broom, texture perpendicular to pavement direction.

B. Curbs and Gutters: Light broom, texture parallel to pavement direction.

C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.09 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
   3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

3.11 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

END OF SECTION