

Approved

State of Idaho
DOPL

PA#: 2055785
Date: 8/6/2026

These documents are approved contingent on the compliance with the mark-ups and notes applied.

This approval shall not be construed to be an approval of any violation of, or variance from, Idaho's adopted codes, standards, laws or rules applicable to this project.

DIVISION OF OCCUPATIONAL &
PROFESSIONAL LICENSES

DOPL

Construction Project Manual

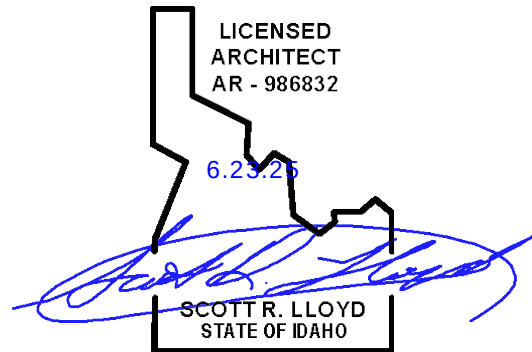
SET NO.



MAY 2026

ISU: EAMES BUILDING 96 REMODEL POCATELLO, ID

DPW PROJECT # 26-233



CONSTRUCTION APPROVAL BY RESPONSIBLE CHIEF OFFICER OF INSTITUTION OR AGENCY

(IDAHO CODE 67-5710)

20260215 ISU Eames Building 96 Remodel

20260215

This project incorporates the required program elements within the funding limitations authorized, and authorize the Division of Public Works to proceed with bidding of the project. If acceptable bids are received, I will approve awarding a contract and construction of the facilities in accordance with the plans and specifications.

State: State University

Agency Signature Authority: Mark Anderson

Approval: ☒ Approved

Number or Role	Approved
1. Agency - Signature Authority	Approved Mark Anderson Jun 26, 2026 12:14 PM MST
2. Project Manager	Approved Mark Anderson Jun 26, 2026 12:14 PM MST
3. Project Manager Review	Approved Mark Anderson (2026) Jun 26, 2026 12:15 PM MST
4. Office Administrator	Approved Mark Anderson Jun 17, 2026 12:08 PM MST

Architects Project No. 2602



PROJECT MANUAL

**IDAHO STATE UNIVERSITY
EAMES BUILDING 96 REMODEL
POCATELLO, IDAHO
DPW PROJECT # 26 233
ARCHITECT'S PROJECT #2602**

OWNER

STATE OF IDAHO
Division of Public Works
502 North 4th Street
Boise, Idaho 83720-6000

ARCHITECT

JHS ARCHITECTS, P.A.
125 N. Garfield
Pocatello, Idaho 83204

MECHANICAL/PLUMBING ENGINEER

NWESI
9196 W Emerald St, Suite 190
Boise, Idaho 83704

ELECTRICAL ENGINEER

MB Engineering, LLC
645 W. 25th St
Idaho Falls, Idaho 83402

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COMMERCIAL BUILDING

PLAN REVIEW NOTES

These notes shall always be attached to the stamped approved plans and documents. These are part of the plans and shall be a permanent record with the plans.

2055785

These plans have been reviewed for building code compliance based on the submitted documents and plan sheets and have been found to be substantially compliant with the adopted codes. All other code compliance requirements shall be completed through field inspections, verifications, and approvals by the field building inspector.

Section 107.3.1, 2018 IBC. Approval of construction documents. *When the building official issues a permit, the construction documents shall be approved, in writing or by stamp, as "Reviewed for Code Compliance." One set of construction documents reviewed shall be retained by the building official. The other set shall be returned to the applicant, shall be kept at the site of work and shall be open to inspection by the building official or a duly authorized representative.*

A complete set of stamped approved plans which include all documents submitted for plan review (E.g. approved stamped plans, plan review notes, stamped engineering calculations, stamped truss drawings and calculations, Res/Com-checks, and all manufactures installation instructions for all manufactured products.) shall be on site for inspector verification. Without a complete set of documents inspections cannot take place.

Section 105.4, 2018 IBC. Validity of permit. *The issuance or granting of a permit shall not be construed to be a permit for, or the approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction, of errors in the construction documents and other data. The building official is authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this jurisdiction.*

Section 110.5, 2018 IBC. Inspection requests. *It shall be the duty of the holder of the building permit or their duly authorized agent to notify the building official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code. (See section 110.3 2018 IBC. for required inspections)*

107.4 2018 IBC. Amended construction documents.

Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents. Any substantial changes shall be resubmitted for plan review at the inspector's discretion.

Section 110.1, 2018 IBC. *Approval of the result of an inspection shall not be construed to be an approval of a violation of the provisions of the code or of other ordinances of the jurisdiction. Inspections presumed to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid.*

[A] 107.3.4.1 Deferred submittals. *Documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by the building official.*

Add Alternates, *approved in the plan review process, that will be completed under this permit, shall be listed in Oasis under the description of work, to ensure that all required compliance for final inspections and the issuance of certificate of occupancies will be met. Inspectors will inspect only, listed add alternates in the inspection process. **Any add alternates that are not listed will require separate permits and inspections.***

Listing the Add Alternates

On company letter head, the construction manager will sign and date a request for the specific add alternate(s) to be listed in Oasis, to the BCRC permit techs at bcre-permits@dopl.idaho.gov

At that time the request letter will become a part of the approved plans and the requested alternates added to Oasis.

Certificates of Occupancy will be given only when all permitted work is completed and final inspection approved.

Penetrations Note

Any penetration, whether a membrane penetration or through penetration of any horizontal assemblies, smoke assemblies, fire-resistance-rated wall assemblies, and fire-resistance-rated floors, or ceiling assemblies must be protected and inspected if penetrated.

The provisions of chapter 7 of the 2018 IBC shall govern the materials and methods of construction used to protect duct penetrations, through penetrations and membrane penetrations of rated assemblies. A building permit for the inspection of such alterations, penetrations and protections shall be made, and building inspections called for approval.

Safeguards during construction and demolition shall be as per chapter 33 of the 2018 IBC.

Construction safeguards of section 3302 of the 2018 IBC shall be followed at all times during the demolition and construction process. It is the responsibility of the design professional, contractor, and owner to ensure that all safeguards are taken within the scope of this project to ensure safety to all workers, pedestrians, and tenants during any construction operations.

1704.2 Special inspections and tests. *Where application is made to the building official for construction as specified in Section 105, the owner or the owner's authorized agent, other than the contractor, shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705 and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building officials that are identified in Section 110. The Special inspection report is to be shown to the building inspector upon building inspection. A final report documenting special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official.*

The Idaho Division of Occupational & Professional Licenses does not enforce the requirements of the ADA; the State of Idaho has adopted the 2009 ANSI A117.1 for accessibility. The ADA is regulated and enforced by the DOJ alone. No ADA requirements were held to compliance in this plan review. It is solely the responsibility of the contractor, architect and or owner to insure compliance with any and all ADA requirements for this project.

Fire code officials shall ensure that all fire protection features (E.g. fire suppression systems, alarms, signage, warning devices, wiring, smoke detection systems, fire extinguishers, automatic fire extinguishing systems, etc.) are compatible and compliant with all jurisdictional and adopted code requirements through plan review and on site field inspections.

It is the responsibility of the owner the design professionals and the contractor to ensure complete code compliance with this project. Any lack of information, questions or deviations shall be brought to the attention of the registered design professional of record for approval

Final approval of all code compliance for this project will be based upon the 2018 IBC through field inspections, verifications, and approval by the field inspectors.

BOILERPLATE

(USING TRADITIONAL DESIGN – BID – BUILD PROCESS)

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T1 TITLE, VICINITY MAP, INDEX OF DRAWINGS, CODE REVIEW & SYMBOLS

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A1.1 OVERALL FLOOR PLAN
A1.2 CONSTRUCTION LIMITS DEMOLITION PLAN
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A1.4 CONSTRUCTION LIMITS REFLECTED CEILING PLAN
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A2.3 PARTIAL DIMENSION FLOOR PLAN - AREA 'A'
A2.4 PARTIAL DIMENSION FLOOR PLAN - AREA 'B'
A2.5 PARTIAL REFLECTED CEILING PLAN - AREA 'A'
A2.6 PARTIAL REFLECTED CEILING PLAN - AREA 'B'
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A3.2 WALL TYPES AND DETAILS
A3.3 DOOR SCHEDULE, DOOR & WINDOW TYPES
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A12.1 INTERIOR ELEVATIONS
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A12.4 INTERIOR ELEVATIONS
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SE-111 PLAN AND DETAILS

PLUMBING DRAWINGS:

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P011 PLUMBING CALCULATIONS
P100 OVERALL PLUMBING PLAN
P111 WASTE AND VENT DEMO PLAN
P121 WATER AND GAS DEMO PLAN
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P211 WASTE AND VENT PLAN
P221 WATER AND GAS PLAN
P241 PLUMBING ROOF PLAN
P711 PLUMBING DETAILS
P712 PLUMBING DETAILS
P811 PLUMBING SCHEDULES

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M011 HVAC ENERGY COMPLIANCE & CALCS
M100 OVERALL HVAC PLAN
M101 HVAC ZONING PLAN
M111 HVAC DEMO PLAN
M141 HVAC ROOF DEMO PLAN
M211 PARTIAL HVAC PLAN 'A'
M212 PARTIAL HVAC PLAN 'B'
M241 HVAC ROOF PLAN
M711 HVAC DETAILS
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M912 MECHANICAL CONTROL SEQUENCES

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ADVERTISEMENT FOR BIDS

Sealed proposals will be received by Division of Public Works, State of Idaho at the DPW Pocatello Field Office, 611 Wilson, Suite 1 Pocatello, ID until 2:00 PM, local time, on Thursday September 10th, 2026 for DPW Project No. 26-233.

**DPW 26 233
ISU EAMES BUILDING 96
REMODEL
Pocatello, ID**

A description of the Work of this project can be summarized to include the Remodel of approximately 24,000 sq ft of existing unused research space into new classrooms, studio spaces, and offices.

Proposals will be opened and publicly read at the above hour and date.

Plans, specifications, proposal forms and other information are on file for examination at the following locations:

- Division of Public Works, 502 N. 4th Street, Boise, ID, 83702; (208) 332-1900
- JHS Architects, P.A., 125 N Garfield Ave., Pocatello, ID 83204; (208) 232-1223
- Associated General Contractors, 1649 W Shoreline Drive, Ste. 100, Boise, ID 83702; (208) 344-2531
Email address: <https://www.idahoagc.org/plan-room>
- Blueprint Specialties, 6205 W. Overland Road, Boise, ID 83709; (208) 377-0294
Email address: www.docuproject.com

A bid bond in the amount of 5% of the total bid amount, including any add alternates, is required.

One set of documents may be obtained by licensed general contractors and by licensed mechanical and electrical subcontractors from the Design Professional for a refundable deposit of \$ 100.00. Others may obtain documents at cost, non-refundable.

A pre-bid conference will be held at the ISU Eames Building #96, 1999 Alvin Ricken Dr., Pocatello, ID on Tuesday August 18th, 2026 starting at 10:00 AM. Bidder attendance is strongly encouraged and recommended.

A Public Works Contractors License for the State of Idaho is required to bid on this Work.

Estimated Cost: \$ 4,988,300.00

DATED: _____

Dan Asbury, Deputy Administrator
Division of Public Works

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INSTRUCTIONS TO BIDDERS

GENERAL PROVISIONS

DEFINITIONS: Capitalized terms used in these Instructions to Bidders (“Instructions”) shall have the meaning given to them in the Division of Public Works’ Fixed Price Construction Contract Between Owner and Contractor.

HEADINGS: Headings used in these Instructions are for convenience only.

REJECTION OF BIDS, WAIVER OF INFORMALITIES OR CANCELLATION: Prior to the effective date of a contract, the Administrator of the Division of Public Works shall have the right to accept or reject all bids, to waive any minor deviations/informalities or to cancel the bid.

ORAL INFORMATION: Questions concerning a bid must be directed in writing to the designated Design Professional (architect or engineer) no less than ten (10) calendar days before bids are due unless provided otherwise via an addendum. Oral information is not binding and any reliance by a bidder on any oral information or representation is at the bidder’s sole risk. Any information given a prospective bidder in response to a written question will be provided to all prospective bidders by an addendum, if such information is necessary for purposes of submitting a bid or if failure to give such information would be prejudicial to uninformed bidders.

PUBLIC RECORDS: The Idaho Public Records Law, Title 74, Chapter 1, Idaho Code, allows the open inspection and copying of public records. Public records include any writing containing information relating to the conduct or administration of the public’s business prepared, owned, used, or retained by a State or local agency regardless of the physical form or character. Unless exempted by the Public Records Law, your bid will be a public record subject to disclosure under the Public Records Law. Any questions regarding the applicability of the Public Records Law should be addressed to your legal counsel prior to submission.

FORM OF AGREEMENT: Unless otherwise specified in the bid documents, the agreement between the successful bidder and the Owner (“State of Idaho”) shall be the Division of Public Works’ Fixed Price Construction Contract Between Owner and Contractor.

PERFORMANCE AND PAYMENT BONDS: A performance bond and payment bond are required for this Project, each in an amount of not less than one hundred percent (100%) of the Contract Price. The performance and payment bonds shall be AIA Document A312, 1984 or the most recent Edition, or a standard surety form certified approved to be the same as the AIA A312 form and shall be executed by a surety or sureties reasonably acceptable to the Owner and authorized to do business in the State of Idaho. Bonds must be provided within ten (10) calendar days following receipt of a Notice of Intent to Award.

BID SUBMISSION PROCESS

BID DOCUMENTS: The bid documents are available from the Design Professional or as provided in the Invitation to Bid or advertisement for bids. The responsibility is on the bidder to use a complete set of bid documents to prepare its bid and neither the Owner nor the Design Professional shall incur any liability for the bidder's failure to do so. Bidders obtain no ownership interest or any use rights, except to use in preparation of their bid, by issuance of the bid documents.

Bidders and Sub-bidders shall field verify all dimensions pertaining to the Work and shall be responsible for the determination of all quantities of materials required for the completion of the Work. The bidder shall not rely on the scale drawings of the Bidding Documents in its determination of required materials quantities. No allowance shall be made for Bidder's failure to field-verify dimensions.

If a deposit is required, the deposit will be returned to a bidder returning the complete bid documents in good condition no more than twenty (20) days after a Notice of Intent is issued and the amount of any deposit returned may be reduced if the bid documents returned are not complete or are damaged. A bidder awarded a Contract may also keep the bid documents and any deposit will be returned.

ADDENDA: In the event it becomes necessary to revise any part of the bid documents, addenda will be issued. Information given to one bidder will be available to all other bidders if such information is necessary for purposes of submitting a bid or if failure to give such information would be prejudicial to uninformed bidders. It is the bidder's responsibility to check for addenda prior to submitting a bid. A bidder is required to acknowledge receipt of all addenda by identifying the addenda numbers in the space provided on the bid proposal form. Failure to do so may result in the bid being declared non-responsive. No addenda will be issued less than four (4) calendar days before the closing date unless the bid closing date is extended.

REVIEW: It is the bidder's responsibility to review the bid documents and compare them as needed, including, with regard to, any other Work that is or may be under construction that might affect the bidder or its Work, to examine the site and local conditions and to report, in writing, any questions, errors, inconsistencies or ambiguities to the Design Professional.

BID FORM: Bids must be submitted on the bid proposal forms, or copies of forms, furnished by the Owner or the Design Professional. Bids submitted must contain all original signatures in ink on the following forms:

1. Bid Proposal Form;
2. Contractor's Affidavit Concerning Alcohol and Drug-Free Workplace;
3. Bidder's Acknowledgment Statement and;
4. Bid Bond (bid security).

The person signing the Bid Proposal Form must initial any and all changes appearing on any of the bid forms. If the bidder is a corporation or other legal entity, the bid forms must be signed by an authorized designee. Oral, telephonic, telegraphic, facsimile, or other electronically transmitted bid forms and/or signatures will not be considered.

BID PRICES: The bid form may require bidders to submit bid prices for one (1) or more items on various bases, including lump sum base bid, lump sum bid alternate prices, unit prices or any combination thereof. Bid amounts shall be expressed in words and numbers. The amount in words shall prevail if there is a discrepancy.

ALTERNATES: If the solicitation/bid includes alternate bid items or unit prices, failure to bid on the alternates or unit prices may disqualify the bid. If bidding on an alternate does not change the base bid, indicate by “No Change.” If bidding on all items is not required by the Contract Documents, bidders must affirmatively indicate that they are not bidding on those items.

TIME FOR SUBMISSION: Bids must be submitted on or before the time specified in the advertisement for bids. Any bid submitted late will be rejected.

SEALED ENVELOPE: Bids shall be submitted in a sealed envelope with the following clearly printed on the outside of the envelope: the Project number and Project name; the name and address of the bidder; and a statement, such as “BID ENCLOSED” to indicate that it is a bid.

MAILED BIDS: When bids are mailed or shipped, the sealed envelope containing the bid shall be enclosed in a separate mailing envelope with the notation “SEALED BID ENCLOSED” on the face thereof. If mailed, the mailing envelope shall be addressed as follows:

Division of Public Works
Attn: Fred Richards
611 Wilson, Suite 1
Pocatello, ID 83201

It is the bidder’s responsibility to ensure that its bid is delivered to the place designated for receipt on or before the specified closing time. The Owner assumes no responsibility for delays in the delivery of mail by the U.S. Post Office or private couriers. Bidders should be advised the intra-state mail system may increase delivery time from arrival at Central Postal to the place designated for receipt and should plan accordingly. **LATE SUBMISSIONS WILL BE REJECTED, WILL NOT BE OPENED AND WILL BE RETURNED TO THE BIDDER. NO DEVIATIONS WILL BE ALLOWED.**

BID CLOSING DECLARED: Immediately prior to the bid opening, the Owner’s representative will declare the official bid closing. Any part of a bid not received prior to the bid closing declared by the designated representative will not be considered and will be returned to the bidder unopened. All bids shall be taken under advisement.

DRUG-FREE WORKPLACE: Along with its bid, the bidder shall submit an affidavit certifying compliance with Title 72, Chapter 17, Idaho Code, requiring the Contractor and its subcontractors at the time of bid to provide a drug-free Workplace program and to maintain such program throughout the duration of the Contract. The form of affidavit is attached.

ILLEGAL ALIENS: Bidder shall warrant that the bidder does not knowingly hire or engage any illegal aliens or persons not authorized to Work in the United States; bidder shall take steps to verify that it does not hire or engage any illegal aliens or persons not authorized to Work in the United

States; and that any misrepresentation in this regard or any employment of persons not authorized to Work in the United States constitutes a material breach and shall be cause for the imposition of monetary penalties and/or termination of any Contract resulting from this bid.

LEGAL RESIDENCY REQUIREMENT: By submitting a bid, the bidder attests, under penalty of perjury, that it (the bidder) is a United States citizen or legal permanent resident or that it is otherwise lawfully present in the United States pursuant to federal law. Prior to being issued a contract, the bidder will be required to submit proof of lawful presence in the United States in accordance with §67-7903, Idaho Code.

BIDDER'S ACKNOWLEDGEMENT STATEMENT: The attached Bidder's Acknowledgement Statement must be completed and included, or the bid may be found non-responsive.

PUBLIC WORKS CONTRACTOR'S LICENSE: This Project is not financed in whole or in part by federal funds. Bids will be accepted from those Contractors only (prime contractors, subcontractors and/or specialty contractors) who, prior to the bid opening, hold current licenses as public Works contractors in the State of Idaho.

IDAHO LABOR REQUIREMENTS: This Project is subject to the provisions of Sections 44-1001 and 44-1002, Idaho Code, dealing with labor preference.

IDAHO PREFERENCE LAW: Section 67-2348, Idaho Code, requires the Division of Public Works to apply a preference in determining which Contractor submitted the lowest responsible bid. If the Contractor who submitted the lowest dollar bid is domiciled in a state with a preference law that penalizes Idaho domiciled contractors, the Division of Public Works must apply the preference law (percentage amount) of that domiciliary state to that Contractor's bid.

NAMING OF SUBCONTRACTORS: Section 67-2310, Idaho Code, requires general (prime) Contractors to include in their bid the name of the subcontractors who shall, in the event the Contractor secures the Contract, subcontract the plumbing, HVAC, and electrical Work under the general (prime) Contract. Failure to name subcontractors as required by this section shall render any bid submitted by a general (prime) Contractor nonresponsive and void. Subcontractors named in accordance with the provisions of this section must possess an appropriate license or certificate of competency issued by the State of Idaho covering the Contractor Work classification in which the subcontractor is named.

The Division of Public Works interprets Section 67-2310, Idaho Code, to mean three (3) separate areas of Work: plumbing Work, HVAC, and electrical Work. The Division of Public Works also requires that the general (prime) Contractor name the entity that will perform the Work, including if the entity is a subcontractor, a sub-subcontractor or the general (prime) Contractor submitting the bid. Failure to complete the Bid Proposal in full shall render a bid nonresponsive and void.

With regard to possessing an appropriate license or certificate of competency, all subcontractors listed by the general (prime) Contractor must have at the time of the bid opening a current license in the appropriate category (class, type and specialty category) as issued by the Public Works Contractors State License Board. In addition, plumbing, HVAC and electrical subcontractors shall have at the time of the bid opening a valid plumbing contractor's license, HVAC contractor's license or electrical

contractor's license, respectively, as issued by the Idaho Division of Occupational and Professional Licenses.

In determining if the above listed subcontractors are required on the Project, the Division of Public Works will refer to the plans and specifications. If doubt exists prior to bid closing, potential bidders should contact the Division of Public Works and the Design Professional who prepared the plans and specifications will be requested to make the determination. If plumbing, HVAC or electrical Work are not shown on the plans and specifications but are discovered by the bidder prior to the date of bid opening, then the bidder must request clarification from the Design Professional. Absent such clarification, Work will be considered incidental, and naming of a subcontractor will not be required.

BID SECURITY

AMOUNT AND FORM OF SECURITY: To be considered, bids must be accompanied by an acceptable bid security in an amount not less than five percent (5%) of the total amount of the bid, including additive alternates. The security may be in the form of a bond or a certified or cashier's check. A standard surety bid bond form meeting all the conditions of AIA Document A310 is acceptable and, if used, must include a certified and current copy of the power of attorney if the bond is executed by the attorney-in-fact on behalf of the surety.

FORFEITURE: A successful bidder who fails to sign the Contract for the Work or furnish the required bonds within ten (10) calendar days following the receipt of notice of intent to award a Contract is subject to forfeiture in accordance with Section 54-1904E, Idaho Code.

RETENTION OF SECURITY: Bid security shall be retained for no more than forty-five (45) calendar days after the opening of bids, so long as the bidder has not been notified of the acceptance of the bid.

BID WITHDRAWAL

PRIOR TO BID CLOSING: If a bid has been submitted, it may be withdrawn in person by a bidder's authorized representative before the opening of the bids. A bidder's representative will be required to show identification and sign on a bid summary sheet before it will be released. After bid closing, no bid may be withdrawn except in strict accordance with these Instructions or applicable law.

BID MODIFICATION

PRIOR TO BID CLOSING: If a bid has been submitted, it may be modified by the submission of a written document contained in a separate sealed envelope marked "Bid Modification from [Name of Bidder] for DPW Project No: 26-233; ISU: Eames Building 96 Remodel, Pocatello, ID." **THE DOCUMENT MODIFYING THE BID MUST BE SIGNED IN INK BY AN AUTHORIZED REPRESENTATIVE OF THE SUBMITTING BIDDER. THE DIVISION OF PUBLIC WORKS RESERVES THE RIGHT TO REQUIRE PRESENTATION OF EVIDENCE SATISFACTORY TO IT TO ESTABLISH THE AUTHORITY TO ACT ON BEHALF OF THE SUBMITTING BIDDER. NO OTHER FORM OF MODIFICATION (INCLUDING TELEPHONE, FACSIMILE OR ELECTRONIC**

MAIL) WILL BE ACCEPTED. AFTER BID CLOSING, NO BID MAY BE MODIFIED EXCEPT IN STRICT ACCORDANCE WITH THESE INSTRUCTIONS OR APPLICABLE LAW.

RELIEF FROM BIDS

CONDITIONS FOR RELIEF: Relief from bids is subject to Sections 54-1904B through 54-1904E, Idaho Code. In the event a bidder discovers a mistake in its bid following the bid opening and wishes to withdraw its bid, the bidder shall establish to the satisfaction of the Owner, pursuant to Section 54-1904C, Idaho Code, that a clerical or mathematical mistake was made; the bidder gave the public entity (Owner) written notice within five (5) calendar days after the opening of the bid of the mistake, specifying in the notice in detail how the mistake occurred; and the mistake was material.

DETERMINATION: If the Owner determines that the bidder has satisfied the requirements of Section 54-1904C, Idaho Code, to entitle it to relief from a bid because of a mistake, it shall prepare a report in writing to document the facts establishing the existence of each required element. The report shall be available for inspection as a public record and shall be filed with the public entity soliciting bids. A bidder claiming a mistake and satisfying all the required conditions of Section 54-1904C, Idaho Code, shall be entitled to relief from the bid and have any bid security returned by the Owner. Bidders not satisfying the conditions of Section 54-1904C, Idaho Code shall be subject to forfeiture in accordance with Section 54-1904B, Idaho Code. A bidder who claims a mistake or who forfeits its bid security shall be prohibited from participating in any re-bidding of that project on which the mistake was claimed, or security forfeited, and the Owner may award the Contract to the next lowest responsive and responsible bidder.

BIDDER'S REPRESENTATIONS

REPRESENTATIONS UPON SUBMITTING A BID: By submitting its bid, a bidder represents and warrants the following:

1. The person signing the bid is authorized to bind the bidder;
2. It has all required licenses, permits or other authorizations necessary to submit its bid;
3. It has taken steps necessary to ascertain the nature and location of the Work and has investigated and satisfied itself as to the general and local conditions which can affect the Work or its cost, including but not limited to: (i) conditions bearing upon transportation, disposal, handling and storage of materials; (ii) the availability of labor, water, natural gas, electric power and roads; (iii) uncertainties of weather, river stages or similar physical conditions at the site; (iv) the conformation and conditions of the ground; and (v) the character of equipment and facilities needed preliminary to and during the Work;
4. It has satisfied itself as to character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including exploratory Work done by the Owner as well as from the drawings and specifications provided as part of the bid package, and that any failure of the bidder to take such actions will not relieve the bidder from responsibility for estimating properly the difficulty and cost of successfully performing the Work;
5. It has received, read and reviewed the Contract, has submitted any questions in writing regarding the same and has received an answer to such questions;
6. Its bid is based upon the requirements of the Contract without exception;

7. It is in compliance with Title 72, Chapter 17, Idaho Code, regarding a drug-free Workplace and has included the required affidavit regarding the same;
8. Its bid is in compliance with employment of persons authorized to Work in the United States;
9. It will retain bid security and hold and honor all base bid prices for forty-five (45) calendar days from the date of bid opening, and cannot be withdrawn after the bid opening;
10. Its bid prices shown for each item on the bid proposal form include all labor, material, equipment, overhead and compensation to complete all the Work for that item; and
11. It has included in its bid amount Idaho sales and/or use taxes on all materials and equipment and all other taxes imposed by law.

BID AWARD

AWARD METHOD: Public Works construction contracts for the State of Idaho are awarded to the "lowest responsible and responsive bidder." The low bidder, for purposes of award, shall be the responsible and responsive bidder offering the low aggregate amount for the base bid item, plus any additive or deductive bid alternates selected by the Owner, and within funds available as determined by the Owner. Bid Award is also subject to the requirements of Idaho Code, including without limitation: Title 67, Chapter 57; Title 67, Chapter 23; Title 54, Chapter 19; and Title 44, Chapter 10. It is the bidder's responsibility to conform to **ALL** applicable federal, state, and local statutes or other applicable legal requirements. The information provided herein is intended to assist bidders in meeting applicable requirements but is not exhaustive and the Owner will not be responsible for any failure by any bidder to meet applicable requirements.

DETERMINATION OF RESPONSIBILITY: The Owner reserves the right to make reasonable inquiry about or from the submitting bidder or from third parties to determine the responsibility of a submitting bidder. Such inquiry may include, but not be limited to, inquiry regarding experience and expertise related to the Project, manpower and other resources, financial stability, credit ratings, references, potential subcontractors, and past performance. The unreasonable failure of a submitting bidder to promptly supply any requested information may result in a finding of non-responsibility.

NOTICE OF EFFECTIVENESS: No Contract is effective until the authorized Owner's official has signed the Contract and the Notice to Proceed has been issued. The bidder shall not provide any goods or render services until the Contract has been signed by the Administrator of the Division of Public Works and the Contract has become effective. Furthermore, the Owner is in no way responsible for reimbursing the bidder for goods provided or services rendered prior to the signature of the authorized Division of Public Work's official and the arrival of the Notice to Proceed.

INCURRING COSTS: The Owner is not liable for any cost incurred by bidders prior to the Notice to Proceed.

PRIOR ACCEPTANCE OF DEFECTIVE BIDS OR PROPOSALS: The Owner generally will not completely review or analyze bids that appear to fail to comply with the requirements of the bid documents, nor will the Owner generally investigate the references or qualifications of those who submit such bids. Therefore, any acknowledgment that the selection is complete shall not operate as a representation by the Owner that an unsuccessful bid was responsive, complete, sufficient, or lawful in any respect.

POST-AWARD SUBMITTALS: Upon receipt of a Notice of Intent to Award, the apparent low responsive and responsible bidder shall provide documentation required in such Notice. Such Notice of Intent to Award shall generally require the bidder to return to the Owner, within ten (10) days of receipt, a signed Contract, all required bonds, proof of insurance and documentation required by the Idaho State Tax Commission (report and affidavit).

OWNER'S RIGHT TO REJECT: Prior to execution of the Contract, the Owner or Design Professional shall provide written notice of any reasonable objection to any person or entity proposed by the bidder. Upon receipt of such notice, the bidder may withdraw its bid, without forfeiture, or propose a substitute and identify any change in any bid amount caused by such substitution. The Owner may accept or reject the substitution or the adjusted price. If the Owner rejects the substitution or the adjusted price, it will return the bidder's bid guarantee.

END OF INSTRUCTIONS

BID PROPOSAL

TO: STATE OF IDAHO
DIVISION OF PUBLIC WORKS

To Whom it May Concern:

The Bidder, in compliance with your Invitation for Bids for the construction of (DPW Project No. and Name): 26-233; ISU: Eames Building 96 Remodel, Pocatello, ID, having examined the bidding and Contract Documents and the site of the proposed Work, and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies and to provide the service and insurance in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the Work required under the Contract Documents.

Bidder hereby agrees to commence Work under this Contract on a date to be specified in the written "Notice to Proceed" of the Owner and to substantially complete the Project within 274 consecutive calendar days thereafter, as stipulated in the specifications. Bidder further agrees to pay as liquidated damages, the sum of \$ 500.00 for each consecutive calendar day after the established substantial completion date or adjusted date as established by change order.

Bidder acknowledges receipt of Addenda No. _____.
(List all Addenda)

BASE PROPOSAL: Bidder agrees to perform all the base proposal Work described in the specifications and shown on the plans for the sum of:

_____ Dollars (\$_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

Alternate No. 1: FLOOR, CEILING FINISHES IN CORRIDOR 174

Add the sum of _____ Dollars (\$_____)

Alternate No. 2: CLASSROOM STOREFRONT

Add the sum of _____ Dollars (\$_____)

Alternate No. 3: PROCUREMENT AND INSTALLATION OF RTU #24

Add the sum of _____ Dollars (\$_____)

Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informality in the bidding.

The bidder agrees that this bid shall be good for a period of forty-five (45) calendar days after the scheduled opening time for receiving bids.

Upon receipt of written Notice of Intent to Award of this bid, Bidder will execute the formal Contract within ten (10) calendar days and deliver a Surety Bond or Bonds as required by paragraph "Performance and Payment Bonds" first page (ITB-1) of the Instructions to Bidders.

The bid security in the amount of five percent (5%) of the bid amount is to become the property of the Owner, in the event the Contract and bond are not executed within the time set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

The names and addresses of the entities who will perform the Work identified below, subject to approval of Owner and Design Professional, if Undersigned is awarded the Contract, are as follows:

Plumbing (PWCL Category 15400)

(Name) _____

(Address) _____

Idaho Public Works Contractors License No. _____

Idaho Plumbing Contractors License No. _____

Heating, Ventilating & Air Conditioning (PWCL Category 15700-HVAC)

(Name) _____

(Address) _____

Idaho Public Works Contractors License No. _____

Idaho HVAC Contractors License No. _____

Electrical (PWCL Category 16000)

(Name) _____

(Address) _____

Idaho Public Works Contractors License No. _____

Idaho Electrical Contractors License No. _____

FAILURE TO NAME A PROPERLY LICENSED SUBCONTRACTOR IN EACH OF THE ABOVE CATEGORIES WILL RENDER THE BID UNRESPONSIVE AND VOID.

Should the listing of subcontractors change due to selection of alternates or other similar circumstances, attach explanation.

Bidder warrants that bid has been prepared and that any contract resulting from acceptance of this bid is subject to the Fixed Price Construction Contract.

The undersigned notifies that it is of this date duly licensed as an Idaho Public Works Contractor and further that it possesses Idaho Public Works Contractor's License No. _____, and is domiciled in the State of _____.

Dated this _____ day of _____, 20__.

Respectfully submitted by:

Contractor's Name- Typed

Street or PO Address

City, State and zip code

Authorized Signature

Title

Telephone Number

Email Address

Have you remembered to include bid security (bid bond or a certified or cashier's check), Contractor's Affidavit Concerning Alcohol and Drug-Free Workplace and a signed copy of the Bidder's Acknowledgment Statement with your bid?

CONTRACTOR'S AFFIDAVIT
CONCERNING ALCOHOL AND DRUG-FREE WORKPLACE

STATE OF _____
:SS
COUNTY OF _____

Pursuant to the Section 72-1717, Idaho Code, I, the undersigned, being duly sworn, depose and certify that _____ is in compliance with the provisions of Section 72-1717, Idaho Code; that _____ provides a drug-free Workplace program that complies with the provisions of Title 72, Chapter 17, Idaho Code, and will maintain such program throughout the life of a state construction contract; and that _____ shall subcontract Work only to subcontractors meeting the requirements of Section 72-1717(1)(a), Idaho Code.

FAILURE TO EXECUTE THIS AFFIDAVIT AND SUBMIT IT ALONG WITH YOUR BID SHALL MAKE YOUR BID NON-RESPONSIVE.

Name of Contractor

Address or PO address

City, State, zip code

Signature

Title

Subscribed and sworn to before me this _____ day of _____, _____.

(SEAL)

NOTARY PUBLIC

Residing at: _____

Commission expires: _____

BIDDER'S ACKNOWLEDGMENT STATEMENT

NOTE: THE INFORMATION CONTAINED HEREIN IS A SUMMARY OF VITAL CONTRACT PROVISIONS AND DOES NOT CHANGE THE CONTRACT DOCUMENTS THAT WILL GOVERN THIS PROJECT.

Division of Public Works Project No. 26-233; ISU: Eames Building 96 Remodel, Pocatello, ID

By submitting a bid for this Project, the undersigned bidder agrees that, if awarded the Contract for construction, Contractor will conform to all conditions and requirements of the Contract, including but not limited to:

- Contractor agrees to comply with conditions pertaining to Sections 44-1001 and 44-1002, Idaho Code, requiring the employment of ninety-five percent (95%) bona fide Idaho residents and providing for a preference in the employment of bona fide Idaho residents and regarding the employment of persons not authorized to Work in the United States.
- Contractor will substantially complete the Work within the time stated in the Contract Documents, or as modified by Change Order(s).
- If the Contractor fails to substantially complete the Project within the time stated in the Contract Documents, or as modified by Change Order, the Contractor agrees that the Owner may deduct from the Contract amount liquidated damages in the amount per calendar day, indicated in the Contract Documents, times the number of calendar days until the Project is Substantially Complete, as defined in the Contract Documents and as determined by the Design Professional.
- The Contractor agrees that the amount allowed for overhead and profit on any Change Order is limited to the amounts indicated in subparagraph 16.3.(k) of the Fixed Price Construction Contract Between Owner and Contractor.
 1. For total changes the amount allowed for overhead, profit, bonds and insurance for the Contractor and all subcontractors of any tier combined shall not exceed fifteen percent (15%) of direct costs; or
 2. The Contractor will determine the amount of overhead and profit to be apportioned between the Contractor and its subcontractor of allowable amounts of overhead, profit, bonds and insurance.
- The Contractor agrees that Change Orders are governed by the Fixed Price Construction Contract Between Owner and Contractor General Conditions of the Contract for Construction including as follows:
 1. By the execution of a Change Order, the Contractor agrees and acknowledges that it has had sufficient time and opportunity to examine the change in Work which is the subject of the Change Order and that it has undertaken all reasonable efforts to discover and disclose any concealed or unknown conditions which may, to any extent, affect the Contractor's ability to

perform in accordance with the Change Order. Aside from those matters specifically set forth in the Change Order, the Owner shall not be obligated to make any adjustments to either the Contract Sum or Contract Time by reason of any conditions affecting the change in Work addressed by the Change Order that could have reasonably been discovered or disclosed by the Contractor's examination.

2. Any Change Order fully executed by the Owner, Contractor and Design Professional, including but not limited to, a Change Order arising by reason of the parties' mutual agreement or by mediation, shall constitute a final and full settlement of all matters relating to or affected by the change in the Work, including but not limited to, all direct and consequential costs associated with such change and any and all adjustments to the Contract Price and Contract Time. In the event a Change Order increases the Contract Price, the Contractor shall include the Work covered by such Change Order in the Application for Payment as if such Work was originally part of the Project and Contract Documents.

- Certification Concerning Boycott of Israel. Pursuant to Idaho Code section 67-2346, if payments under the Contract exceed one hundred thousand dollars (\$100,000) and Contractor employs ten (10) or more persons, Contractor certifies that it is not currently engaged in, and will not for the duration of the Contract engage in, a boycott of goods or services from Israel or territories under its control. The terms in this section defined in Idaho Code section 67-2346 shall have the meaning defined therein.
- Ownership or Operation by China. Pursuant to Idaho Code section 67-2359, Contractor certifies that it is not currently owned or operated by the government of China and will not for the duration of the Contract be owned or operated by the government of China. The terms in this section defined in Idaho Code section 67-2359 shall have the meaning defined therein.
- Boycott of Various Industries. Pursuant to Idaho Code section 67-2347A (effective July 1, 2024), if payments under the Contract exceed one hundred thousand dollars (\$100,000) and Contractor employs ten (10) or more persons, Contractor certifies that it is not currently engaged in, and will not for the duration of the Contract engage in, a boycott of any individual or company because the individual or company: a) engages in or supports the exploration, production, utilization, transportation, sale, or manufacture of fossil fuel-based energy, timber, minerals, hydroelectric power, nuclear energy, or agriculture; or b) engages in or supports the manufacture, distribution, sale, or use of firearms. The terms in this section defined in Idaho Code section 67-2347A shall have the meaning defined therein, including through reference to another section of Idaho Code.

FAILURE TO EXECUTE THIS ACKNOWLEDGMENT MAY MAKE YOUR BID NON-RESPONSIVE.

I, _____, being duly authorized to bind
the (type or print name of individual)
bidder, _____, does hereby certify that I have fully read
(type or print name of company)
and understand this document and that it highlights certain parts of the Contract that will be entered
between the parties and that will govern this Project.

Authorized Signature: _____

Title: _____

Date: _____

END OF BIDDER'S ACKNOWLEDGMENT STATEMENT

**DIVISION OF PUBLIC WORKS
FIXED PRICE CONSTRUCTION CONTRACT
BETWEEN OWNER AND CONTRACTOR**

**DPW PROJECT NO. 26-233
IDAHO STATE UNIVERSITY
EAMES BUILDING 96 REMODEL
POCATELLO, ID**

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FIXED PRICE CONSTRUCTION CONTRACT
BETWEEN OWNER AND CONTRACTOR

THIS FIXED PRICE CONSTRUCTION CONTRACT BETWEEN OWNER AND CONTRACTOR (the "Contract") is by and between the State of Idaho, Department of Administration, Division of Public Works ("DPW" or the "Owner") and (insert name of contractor) (the "Contractor") and is for the construction of the project (the "Project") identified as DPW Project No. 26-233, as more fully described in Exhibit A, and incorporated herein by reference. This Contract shall be effective on _____ (day) of _____ (month), 20__ (year), when executed by both parties.

In consideration of the mutual promises, covenants, and agreements stated herein, and for other good and valuable consideration, the sufficiency of which is hereby acknowledged, the Owner and the Contractor agree:

ARTICLE 1
CONTRACT DOCUMENTS

- 1.1 The Contract Documents consist of this Contract, the drawings and specifications for the Project (the "Drawings and Specifications") identified in Exhibit C and any Addenda thereto issued prior to execution of this Contract, written amendments signed by both the Owner and the Contractor, Change Orders signed by both the Owner and the Contractor, Construction Change Directives and any written orders by the Design Professional for minor changes in the Work (the "Contract Documents"). Documents not included or expressly contemplated in this Article 1 do not, and shall not, form any part of the Contract Documents.
- 1.2 The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations.

ARTICLE 2
REPRESENTATIONS AND WARRANTIES OF THE CONTRACTOR

To induce the Owner to execute this Contract and recognizing that the Owner is relying thereon, the Contractor, by executing this Contract, makes the following express representations to the Owner:

- 2.1 The Contractor is fully qualified to act as the Contractor for the Project and has, and shall maintain, any and all licenses, permits or other authorizations necessary to act as the Contractor for, and to construct, the Project.
- 2.2 The Contractor has become familiar with the Project site and the local conditions under which the Project is to be constructed and operated particularly in correlation to the requirements of the Contract.
- 2.3 The Contractor has received, reviewed, compared, studied, and carefully examined all of the documents which make up the Contract Documents, including the Drawings and Specifications, and any Addenda, and has found them in all respects to be complete, accurate, adequate, consistent, coordinated and sufficient for construction. Such review, comparison, study and

examination shall be a warranty that the Contractor believes that the documents are complete and the Project is buildable as described except as reported.

- 2.4 The Contractor warrants that the Contract Time is a reasonable period for performing the Work.
- 2.5 The Contractor warrants to the Owner and Design Professional that all labor furnished on this Project shall be competent to perform the tasks undertaken; materials and equipment furnished under the Contract will be new and of high quality unless otherwise required or permitted by the Contract Documents; that the Work will be complete, of high quality and free from defects not inherent in the quality required or permitted; and that the Work will strictly conform to the requirements of the Contract Documents. Any Work not strictly conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse by Owner or its representatives, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This warranty shall survive the completion of the Contract and final payment to the Contractor.
- 2.6 Required Certifications.
- 2.6.1 **Certification Concerning Boycott of Israel.** Pursuant to Idaho Code section 67-2346, if payments under the Contract exceed one hundred thousand dollars (\$100,000) and Contractor employs ten or more persons, Contractor certifies that it is not currently engaged in, and will not for the duration of the Contract engage in, a boycott of goods or services from Israel or territories under its control. The terms in this section defined in Idaho Code section 67-2346 shall have the meaning defined therein.
- 2.6.2 **Ownership or Operation by China.** Pursuant to Idaho Code section 67-2359, Contractor certifies that it is not currently owned or operated by the government of China and will not for the duration of the Contract be owned or operated by the government of China. The terms in this section defined in Idaho Code section 67-2359 shall have the meaning defined therein.
- 2.6.3 **Disclosure of Abortion Related Matters.** The State is subject to the No Public Funds for Abortion Act, Idaho Code title 18, chapter 87 (the "Act") and State employees who intentionally violate the provisions of the Act are subject to criminal prosecution. Contractor must disclose, unless Contractor is within one of the exemptions provided in the Act, if it or an affiliate is or becomes, during the term of the Agreement, an abortion provider and if it will use state facilities or public funds to provide, perform, participate in, promote or induce, assist, counsel in favor, refer or train a person for an abortion related activity. Please refer to the Act for definitions of the terms used in this section.
- 2.6.4 **Boycott of Various Industries.** Pursuant to Idaho Code section 67-2347A (effective July 1, 2024), if payments under the Contract exceed one hundred thousand dollars (\$100,000) and Contractor employs ten (10) or more persons, Contractor certifies that it is not currently engaged in, and will not for the duration of the Contract engage in, a boycott of any individual or company because the individual or company: a) engages in or supports the exploration, production, utilization, transportation, sale, or manufacture of fossil fuel-based energy, timber, minerals, hydroelectric power, nuclear energy, or agriculture; or b) engages in or supports the manufacture, distribution, sale, or use of firearms. The terms in this section defined in Idaho Code section 67-2347A shall have the meaning defined therein, including through reference to another section of Idaho Code.

ARTICLE 3
INTENT AND INTERPRETATION

With respect to the intent and interpretation of this Contract, the Owner and the Contractor agree as follows:

- 3.1 This Contract constitutes the entire and exclusive agreement between the parties with reference to the Project, and supersedes any and all prior discussions, communications, representations, understandings, negotiations or agreements. This Contract also supersedes any bid documents.
- 3.2 The intent of the Contract is to include all items necessary for the proper execution and completion of the Project and anything that may be required, implied or inferred by the documents which make up this Contract, or any one or more of them, shall be provided by the Contractor for the Fixed Price Contract Amount. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all.
- 3.3 Nothing contained in this Contract shall create, nor be interpreted to create privity or any other relationship whatsoever between the Owner and any person or entity except the Contractor; provided; however, that the Design Professional is entitled to performance and enforcement of obligations under the Contract intended or necessary to facilitate its duties. Any reference to the Owner, the Contractor, or the Design Professional shall be deemed to include authorized representatives.
- 3.4 When a word, term or phrase is used in this Contract, it shall be interpreted or construed first as defined herein; second, if not defined, according to its generally accepted meaning in the construction industry; and third, if there is no generally accepted meaning in the construction industry, according to its common and customary usage.
- 3.5 The words "include," "includes," or "including," as used in this Contract, shall be deemed to be followed by the phrase "without limitation."
- 3.6 The specification herein of any act, failure, refusal, omission, event, occurrence, or condition as constituting a material breach of this Contract shall not imply that any other, non-specified act, failure, refusal, omission, event, occurrence or condition shall be deemed not to constitute a material breach of this Contract.
- 3.7 The Contractor shall have a continuing duty to read, examine, review, compare and contrast each of the documents which make up this Contract, shop drawings and other submittals, and shall give timely written notice to the Owner and the Design Professional of any conflict, ambiguity, error or omission which the Contractor may find with respect to these documents before proceeding with the affected Work.
- 3.8 The express or implied approval by the Owner or the Design Professional of any shop drawings or other submittals shall not relieve the Contractor of the continuing duties imposed hereby, nor shall any such approval be evidence of the Contractor's compliance with this Contract. The Owner has requested that the Design Professional prepare documents for the Project, including the Drawings and Specifications for the Project Work, which are accurate, adequate, consistent, coordinated, and sufficient for construction. *HOWEVER, THE OWNER MAKES NO REPRESENTATION OR*

WARRANTY OF ANY NATURE WHATSOEVER TO THE CONTRACTOR CONCERNING SUCH DOCUMENTS. The Contractor again hereby acknowledges and represents that it has received, reviewed, and carefully examined such documents; has found them to be complete, accurate, adequate, consistent, coordinated and sufficient for construction; and that the Contractor has not, does not and will not rely upon any representations or warranties by the Owner concerning such documents, as no such representations or warranties have been or are hereby made.

- 3.9** In the event of any conflict among any of the documents which make up this Contract, the Design Professional shall interpret the documents, and the interpretation shall be binding on both the Owner and Contractor; provided, however, that this does not change the Owner's right to make decisions regarding Objections in accordance with Article 13 and Article 14. If no interpretation is provided by the Design Professional, the most stringent requirement in the Contract Documents will apply.

ARTICLE 4

OWNERSHIP OF DOCUMENTS

- 4.1** Unless otherwise agreed by the Design Professional and its consultants, the party that prepared the drawings, specifications and other documents is the author of such with all copyright, common law, statutory and other reserved rights. The Contractor may retain one (1) record set of the Drawings and Specifications and other documents but shall not own or claim any copyright in them.

The Drawings and Specifications and other documents, and any copies, are to be used solely for this project (the "Project"), and not on any other project, or additions to this Project outside this Contract, without written consent of the Owner, the Design Professional, and the Design Professional's consultants; provided, however, that copies may be made of applicable portions as necessary for completion of the Work. Such copies shall include any copyright notice on the Drawings and Specifications and other documents.

Submission to or use by a regulatory body related to this Project is an acceptable use.

ARTICLE 5

CONTRACTOR'S PERFORMANCE

The Contractor shall perform all the Work required, implied or reasonably inferable from this Contract, including the following:

- 5.1** Construction of the Project.
- 5.2** The furnishing of any required surety bonds and insurance.
- 5.3** The provision or furnishing, and prompt payment therefore, of labor, supervision, services, materials, supplies, equipment, fixtures, appliances, facilities, tools, transportation, storage, power, fuel, heat, light, cooling, or other utilities required for construction and all necessary permits, including any required elevator permits, required for the construction of the Project. Construction projects for the State of Idaho require a building permit issued by the Division of Occupational and Professional Licenses.

- 5.4 The creation and submission of a detailed and comprehensive set of marked up blue or black-lined record drawings. Said record drawings shall be submitted to and approved by the Design Professional as a condition precedent to final payment to the Contractor.
- 5.5 The Contractor is solely liable for theft or damage of materials and equipment stored on the Worksite but not yet installed in the facility. The Contractor shall protect and replace any loss of materials due to theft or damage, until final acceptance of the Project.

ARTICLE 6

TIME FOR CONTRACTOR'S PERFORMANCE

- 6.1 The Contractor shall commence the performance of this Contract in accordance with the "Notice to Proceed" (Exhibit F) issued by the Owner and shall diligently continue its performance to and until final completion of the Project. The Contractor shall accomplish Substantial Completion of the Project on or before the time indicated in Exhibit A. The period of time, including any adjustments made under this Contract, for the Contractor to reach Substantial Completion is the "Contract Time."
- 6.2 The Contractor may be assessed by and be responsible to the Owner for the amount indicated in Exhibit A per day for each and every calendar day of unexcused delay in achieving Substantial Completion beyond the date set forth for Substantial Completion. Any sums owed hereunder by the Contractor shall be payable not as a penalty but as liquidated damages, representing an estimate of delay damages likely to be sustained by the Owner estimated at the time of this Contract. When the Owner reasonably believes that Substantial Completion will be inexcusably delayed, the Owner shall be entitled, but not required, to withhold from any amounts otherwise due the Contractor an amount then believed by the Owner to be adequate to recover liquidated damages applicable to such delays. If and when the Contractor overcomes the delay in achieving Substantial Completion, or any part thereof, for which the Owner has withheld payment, the Owner shall promptly release to the Contractor those funds withheld, but no longer applicable, as liquidated damages. The Owner's right to liquidated damages is not, and shall not be deemed to be, an exclusive remedy for delay and the Owner shall retain all remedies at law or in equity for delay or other breach.
- 6.3 The term "Substantial Completion," as used herein, shall mean that point at which, as certified in writing by the Design Professional, or if there is no Design Professional, as certified by the Owner, the entire Project is at a level of completion in strict compliance with the Contract Documents, such that the Owner or its designee can enjoy beneficial use or occupancy and can use or operate it in all respects for its intended purpose. If, in the reasonable determination of the Owner, receipt of operation and maintenance manuals or completion of training is necessary for such beneficial use or occupancy, then there shall be no Substantial Completion until such manuals are provided or such training is completed. Partial use or occupancy of the Project shall not result in the Project being deemed substantially complete, or accepted as substantially complete, and such partial use or occupancy shall not be evidence of Substantial Completion. The Project shall not be deemed accepted until it is finally complete.
- 6.5 Any request by the Contractor for an extension of the Contract Time must be made in accordance with, and is subject to, Article 13, Article 14 related to Objections, and Article 16.

- 6.6 The Owner shall have no liability of any kind to the Contractor if a schedule or other document submitted by the Contractor shows an intention to complete the Work prior to the scheduled completion date and for any reason other than Owner caused delay, the Contractor is not able to achieve such early completion.

ARTICLE 7

FIXED PRICE AND CONTRACT PAYMENTS

- 7.1 The Owner shall pay, and the Contractor shall accept, as full and complete payment for the Contractor's timely performance of its obligations hereunder, the Fixed Price Contract Amount indicated in Exhibit A. The Fixed Price Contract Amount shall not be modified except as provided in this Contract.
- 7.2 Prior to approval of the contract, the Contractor shall prepare and present to the Owner and the Design Professional the Contractor's Schedule of Values apportioning the Fixed Price Contract Amount among the different elements of the Project for purposes of periodic and final payment. The Contractor's Schedule of Values shall be presented in the Owner's web-based construction management software. The Contractor shall not imbalance its Schedule of Values nor artificially inflate any element thereof. The violation of this provision by the Contractor shall constitute a material breach of this Contract. The Contractor's Schedule of Values will be utilized for the Contractor's requests for payment but shall only be utilized after it has been approved in writing by the Design Professional.
- 7.3 The Owner shall pay the Fixed Price Contract Amount to the Contractor in accordance with the procedures set forth in this Article. The Contractor shall submit a Contractor's Request for Payment, on or before the day of each month indicated in Exhibit A or otherwise agreed to, after commencement of performance, but no more frequently than once monthly. Said payment request shall be made in the Owner's web-based construction management software and shall include whatever supporting information as may be required by the Design Professional, the Owner or both. Therein, the Contractor may request payment for one hundred percent (100%) of the Work satisfactorily completed to the date of the Contractor's Request for Payment, less five percent (5%) retainage, based on the Fixed Price Contract Amount allocated on the Schedule of Values. The Contractor's Request for Payment may include only: properly provided labor, materials or equipment properly incorporated into the Project, and time and materials or equipment necessary for the Project or that will be incorporated into the Project and are properly stored at the Project site (or elsewhere if off-site storage is approved in writing by the Owner). The Contractor's Request for Payment must exclude the total amount of previous payments received from the Owner. Any payment on account of stored materials or equipment will be subject to the Contractor providing written proof that the Owner has title to such materials or equipment and that they are fully insured against loss or damage. Each such Contractor's Request for Payment shall be signed by the Contractor and its submission shall constitute the Contractor's affirmative representation that the quantity of Work has reached the level for which payment is requested; that the Work has been properly installed or performed in strict compliance with the Contract; that all Work for which the Owner has previously paid is free and clear of any lien, claim or other encumbrance of any person whatsoever; and that the Contractor knows of no reason why payment should not be made as requested. As a condition precedent to payment, the Contractor shall, if required by the Owner, furnish to the Owner properly executed waivers or releases, in a form acceptable to the Owner, from all subcontractors, materialmen, suppliers or others having any claims or alleged claims, wherein said subcontractors, materialmen, suppliers or others shall

acknowledge receipt of all sums due pursuant to all prior Contractor's Requests for Payment, and waive and relinquish any rights or other claims relating to the Project or Project site. The submission by the Contractor of the Contractor's Request for Payment also constitutes the Contractor's affirmative representation that, upon payment of the Contractor's Request for Payment submitted, title to all Work included in such payment shall be vested in the Owner.

Thereafter, the Design Professional shall review the Contractor's Request for Payment and may also review the Work at the Project site or elsewhere to determine whether the quantity and quality of the Work are as represented in the Contractor's Request for Payment and as required by this Contract. The Design Professional shall approve in writing the amount which, in the opinion of the Design Professional, is properly owing to the Contractor and such approval is required before the Owner shall have any payment obligation. The Design Professional may withhold such approval, in whole or in part, as necessary to protect the Owner if it reasonably believes that the quantity or quality of the Work is not as represented in the Contractor's Request for Payment or is not in strict conformance to the Contract Documents.

- 7.4** The Owner shall make payment to the Contractor no more than forty-five (45) days following receipt by the Owner of the Design Professional's written approval of each Contractor's Request for Payment. The amount of each such payment shall be the amount approved for payment by the Design Professional less such amounts, if any, otherwise owing by the Contractor to the Owner or which the Owner shall have the right to withhold as authorized by this Contract. The Design Professional's approval of the Contractor's Request for Payment shall not preclude the Owner from the exercise of any of its rights it may have in this Contract, at law or in equity, as set forth in Paragraph 7.8 hereinafter.
- 7.5** Off-site storage will not be approved at locations more than thirty (30) miles from the Project site or outside the State of Idaho and any payment for any off-site storage is subject to the following:
- (a) The Contractor must provide at least thirty (30) days' advance written notice of its request to store off-site. Such notice must include a description of the type, quantities, locations, and values of materials involved for the next billing cycle. All invoices must indicate the type, quantities and value of materials or equipment for which payment is requested;
 - (b) All materials stored off-site must be segregated and clearly marked with the DPW Project number and as being the "Property of the State of Idaho;"
 - (c) The Design Professional and/or the Owner's Field Representative must have unrestricted access to the stored materials during all business hours and may physically inventory all invoiced materials and equipment and may physically inspect the storage conditions;
 - (d) The Contractor must provide written Consent of Surety to off-site storage of materials and equipment and to payment for such materials and equipment prior to incorporation in the Work. Consent must be from the Surety. Consent of local broker or agent is not acceptable;
 - (e) The Contractor must maintain and must provide to the Design Professional, upon request, a current log of stored materials and equipment, which reflects when materials and equipment are used or added; and

- (f) The Contractor must obtain and maintain all risk property insurance at replacement cost, with the State of Idaho listed as loss payee on all materials and equipment stored off-site and in transit.

7.6 When payment is received from the Owner, the Contractor shall immediately pay all subcontractors, materialmen, laborer(s), and suppliers the amounts they are due for the Work covered by such payment. The Contractor shall not withhold from a subcontractor or supplier more than the percentage withheld from a payment certificate for the subcontractor's or supplier's portion of the Work. In the event the Owner becomes informed that the Contractor has not paid a subcontractor, materialmen, laborer, or supplier as provided herein, the Owner shall have the right, but not the duty, to issue future checks and payment to the Contractor of amounts otherwise due hereunder naming the Contractor and any such subcontractor, materialmen, laborer or supplier as joint payees. Such joint check procedure, if employed by the Owner, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit the Owner to repeat the procedure in the future.

7.7 Payment to the Contractor, utilization of the Project for any purpose by the Owner, or any other act or omission by the Owner shall not be interpreted or construed as an acceptance of any Work of the Contractor not strictly in compliance with this Contract.

7.8 The Owner shall have and be entitled to the right to refuse to make any payment, including by reducing payment under any Contractor's Request for Payment, and, if necessary, may demand the return of a portion or all of an amount previously paid to the Contractor for reasons that include the following:

- (a) The quality of the Contractor's Work, in whole or part, is not in strict accordance with the requirements of this Contract or identified defective Work, including punch list Work, is not remedied as required by the Contract Documents;
- (b) The quantity of the Contractor's Work, in whole or in part, is not as represented in the Contractor's Request for Payment or otherwise;
- (c) The Contractor's rate of progress is such that, in the Owner's opinion, Substantial Completion or final completion, or both, may be inexcusably delayed or that the Owner will incur additional costs or expense related to repeated Substantial Completion or final completion inspections through no fault of the Owner;
- (d) The Owner reasonably believes that the Contractor has failed to use Contract funds, previously paid the Contractor by the Owner, to pay Contractor's project-related obligations, including subcontractors, laborers and material and equipment suppliers;
- (e) There are claims made or it seems reasonably likely that claims will be made, against the Owner;
- (f) The Contractor has caused a loss or damage to the Owner, the Design Professional or another contractor;
- (g) The Owner reasonably believes that the Project cannot be completed for the unpaid balance of the Fixed Price Contract Amount, or the Owner reasonably believes that the Project cannot be completed within the Contract Time and that the unpaid balance of the

Fixed Price Contract Amount would be inadequate to cover the cost of actual or liquidated damages for the anticipated delay;

(h) The Contractor fails or refuses to perform any of its obligations to the Owner; or

(i) The Contractor fails to pay taxes as required by Title 63, Chapter 15, Idaho Code.

7.9 In the event that the Owner makes a written demand upon the Contractor for amounts previously paid by the Owner as contemplated in Paragraph 7.8, the Contractor shall promptly comply with such demand.

7.10 If the Owner, without cause, fails to pay the Contractor any amounts due and payable sixty (60) days after those amounts are due pursuant to Paragraph 7.4, the Contractor shall have the right to cease the Work until receipt of proper payment. Contractor must first provide written notice to the Owner of the Contractor's intent to cease the Work ten (10) days prior to stopping the Work under this Paragraph. If any amounts remain unpaid after sixty (60) days after the Design Professional approves the Contractor's Request for Payment under Paragraph 7.4, interest in accordance with Idaho Code § 67-2302 shall accrue on those unpaid amounts.

7.11 When the Contractor considers Substantial Completion has been achieved, the Contractor shall notify the Owner and the Design Professional in writing and shall furnish to the Design Professional a listing of those matters yet to be finished. The Design Professional will thereupon conduct an inspection to confirm that the Work is, in fact, substantially complete. Upon its confirmation that the Contractor's Work is substantially complete, the Design Professional will so notify the Owner and Contractor in writing and will therein set forth the date of Substantial Completion. The Owner and the Contractor must accept the date of Substantial Completion in writing. Guarantees and warranties required by this Contract shall commence on the date of Substantial Completion. At the Contractor's Request for Payment following Substantial Completion, the Owner shall pay the Contractor an amount sufficient to increase total payments to the Contractor to ninety-five percent (95%) of the Fixed Price Contract Amount, less any liquidated damages, less the reasonable costs as determined by the Design Professional for completing all incomplete Work, correcting and bringing into conformance all defective and nonconforming Work, and handling any outstanding or potential claims. If the Design Professional determines that the Contractor has made or is making satisfactory progress on any uncompleted portions of the Work, the Owner may, at its discretion, release a portion of the retainage to the Contractor prior to the actual final completion of the conditions set forth in Paragraph 7.14. It is the intent of the parties that the Project will be accepted only in total (at Substantial Completion and final completion) and not in phases unless provided for in Exhibit A. Any acceptance other than in total shall require written agreement of Owner and Design Professional.

7.12 When the Contractor considers the Project is at final completion, it shall notify the Owner and the Design Professional thereof in writing. Thereupon, the Design Professional will perform a final inspection of the Project. If the Design Professional confirms that the Project is complete in full accordance with the Contract Documents and that the Contractor has performed all of its obligations to the Owner, the Design Professional will furnish a final approval for payment to the Owner certifying to the Owner that the Project is complete and the Contractor is entitled to the remainder of the unpaid Fixed Price Contract Amount, less any amount withheld pursuant to this Contract.

- 7.13** If the Contractor fails to achieve final completion within a reasonable number of days as established by the Design Professional from the date of Substantial Completion, the Contractor may be assessed and be responsible to the Owner for fifty percent (50%) of the daily amount of liquidated damages as established pursuant to Paragraph 6.2 and Exhibit A, per day for each and every calendar day of unexcused delay in achieving final completion beyond the date established for final completion of the Work. Any sums due and payable hereunder by the Contractor shall be payable not as a penalty but as liquidated damages representing an estimate of delay damages likely to be sustained by the Owner, estimated at or before the time of executing this Contract. When the Owner reasonably believes that final completion will be inexcusably delayed, the Owner may withhold from any amounts otherwise due the Contractor an amount then believed by the Owner to be adequate to recover liquidated damages applicable to such delays. If and when the Contractor overcomes the delay in achieving final completion, or any part thereof, for which the Owner has withheld payment, the Owner shall promptly release to the Contractor those funds withheld, but no longer applicable, as liquidated damages. The Owner's right to liquidated damages is not, and shall not be deemed to be, an exclusive remedy for delay and the Owner shall retain all remedies at law or in equity for delay or other breach.
- 7.14** As a condition precedent to final payment, the Contractor must furnish the Owner, in the form and manner required by Owner, and with a copy to the Design Professional of the following:
- (a) An affidavit that all of the Contractor's obligations to subcontractors, laborers, equipment or material suppliers or other third parties in connection with the Project have been paid or otherwise satisfied;
 - (b) A release by the Contractor of all Claims it has or might have against the Owner or the Owner's property (DPW's form, Exhibit H);
 - (c) Contractor's Affidavit of Debts and Claims (AIA Document G706);
 - (d) Consent of Surety to final payment (AIA Document G707);
 - (e) Confirmation of all required training, product warranties, operating manuals, instruction manuals and other record documents, drawings and things customarily required of the Contractor; and
 - (f) A Public Works Contract Tax Release issued by the Idaho Tax Commission (See "Request for Tax Release" form, Exhibit G, to be submitted by Contractor to the Idaho Tax Commission).
- 7.15** The Owner shall, subject to its rights set forth in this Contract, make final payment of all sums due to the Contractor within forty-five (45) days of the Design Professional's execution of a final approval for payment and receipt of documentation required by Paragraph 7.14, whichever is received later.

ARTICLE 8
INFORMATION AND MATERIAL SUPPLIED BY THE OWNER

- 8.1** The Administrator of DPW or designee shall be the sole representative of the State of Idaho. The Design Professional shall have authority to bind Owner only as specifically set forth in this Contract.
- 8.2** The Owner will assign a Project Manager and a Field Representative to represent the Owner, identified in Exhibit B. The Owner's Field Representative's duties, responsibilities and limitations of authority are in accordance with DPW's policies and procedures.
- 8.3** The Owner shall furnish to the Contractor, prior to the execution of this Contract, any and all written and tangible material in its possession concerning conditions below ground at the site of the Project. Such written and tangible material is furnished to the Contractor only to make complete disclosure of such material as being in the possession of the Owner and for no other purpose. By furnishing such material, the Owner does not represent, warrant, or guarantee its accuracy, either in whole in part, implicitly or explicitly.
- 8.4** The Owner will secure and pay for all required easements, the plan check fee required by the Division of Occupational and Professional Licenses, conditional use permits and any other permits and fees specifically indicated in the Contract Documents to be secured and paid for by the Owner.
- 8.5** The Owner will provide the Contractor one (1) copy of this complete Contract and the number of sets of Drawings and Project Manuals (including Specifications) as indicated in Exhibit A. The Contractor may purchase additional copies, at its expense, from the Design Professional.

ARTICLE 9

STOP WORK ORDER

- 9.1** In the event the Contractor fails or refuses to perform the Work as required or fails or refuses to correct nonconforming Work, the Owner may instruct the Contractor to stop Work in whole or in part. Upon receipt of such instruction, the Contractor shall immediately stop as instructed by the Owner and shall not proceed further until the cause for the Owner's instructions has been corrected, no longer exists or the Owner instructs that the Work may resume. In the event the Owner issues such instructions to stop, and in the further event that the Contractor fails and refuses within seven (7) days of receipt of same to provide adequate assurance to the Owner that the cause of such instructions will be eliminated or corrected, then the Owner shall have the right, but not the obligation, to carry out the Work with its own forces or with the forces of another contractor, and the Contractor shall be fully responsible and liable for the costs of performing such Work by the Owner. Without limiting what else might constitute nonconforming Work, the existence of a gross safety violation or other situation or condition that creates, or could imminently create, a threat of serious harm to persons or property, shall constitute nonconforming Work and any order to stop the Work issued for such reason shall not be considered an interference with the Contractor's performance of the Work or its means and methods. The rights set forth herein are in addition to, and without prejudice to, any other rights or remedies the Owner may have against the Contractor.
- 9.2** Any order to stop the Work issued pursuant to Paragraph 9.1 shall not be used to justify any Claim by the Contractor for additional time or money.

ARTICLE 10
DUTIES, OBLIGATIONS AND RESPONSIBILITIES OF THE CONTRACTOR

In addition to any and all other duties, obligations and responsibilities of the Contractor set forth in this Contract, the Contractor shall have and perform the following duties, obligations and responsibilities to the Owner:

- 10.1** The Contractor's continuing duties set forth in Paragraph 3.7 are by reference hereby incorporated in this Paragraph 10.1. The Contractor shall not perform Work without adequate plans and specifications or, as appropriate, approved shop drawings or other submittals. If the Contractor performs Work knowing or believing it involves an error, inconsistency, or omission in the Contract without first providing written notice to the Design Professional and Owner, the Contractor shall be responsible for such Work and shall pay the cost of correcting same.
- 10.2** The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing Work. Errors, inconsistencies, or omissions discovered shall be reported to the Design Professional, the Owner and the Owner's Field Representative immediately. Such examination, review and comparison shall be a warranty that the Contract Documents are complete, and the Project is buildable as described except as reported. Reported errors, inconsistencies or omissions will constitute a request for an interpretation by the Design Professional and may constitute an objection pursuant to Article 14 hereof where appropriate.
- 10.3** The Contractor shall ensure that all Work shall strictly conform to the requirements of this Contract.
- 10.4** The Work shall be strictly supervised, the Contractor bearing full responsibility for any and all acts or omissions of those engaged in the Work on behalf of the Contractor.
- 10.5** All labor furnished on this Project shall be competent to perform the tasks undertaken; materials and equipment furnished under the Contract will be new and of high quality unless otherwise required or permitted by the Contract Documents; the Work will be complete, of high quality and free from defects not inherent in the quality required or permitted; and the Work will strictly conform to the requirements of the Contract Documents. Any Work not strictly conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective.
- 10.6** Except as provided in Paragraph 8.4, the Contractor shall secure or provide and pay for all licenses, permits required by the Idaho Division of Occupational and Professional Licenses , governmental approvals and inspections, connections for outside services for the use of municipal or private property for storage of materials, parking, utility services, temporary obstructions, enclosures or opening and patching of streets, and for all other facilities and services necessary for proper execution and completion of the Project.
- 10.7** The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on performance of the Work.

- 10.8** The Contractor shall employ and maintain at the Project site only competent supervisory personnel. Key supervisory personnel assigned by the Contractor to this Project are as listed in Exhibit B.
- 10.9** The Contractor shall employ a competent superintendent and necessary assistants, as needed, to oversee execution of the Work. The superintendent shall be in attendance at the Project site during the progress of the Work. The superintendent and any project manager, if the Contractor utilizes a project manager, shall be reviewed, and must be approved by the Design Professional and Owner, and neither shall be changed except with the consent of the Design Professional and Owner, unless the superintendent and/or project manager cease to be employed by the Contractor. Under this circumstance, any new superintendent or new project manager must be satisfactory to the Design Professional and Owner. Such approval shall not be unreasonably withheld. The superintendent and any project manager shall represent the Contractor and all communications given to the superintendent or project manager are deemed given to the Contractor.
- 10.10** So long as the individuals named above remain actively employed or retained by the Contractor, they shall perform the functions indicated next to their names unless the Owner agrees to the contrary in writing. In the event one or more individuals not listed in Paragraph 10.9 subsequently assumes one or more of those functions listed in Paragraph 10.9, the Contractor shall be bound by the provisions of this paragraph as though such individuals had been listed in Paragraph 10.9.
- 10.11** The Contractor shall provide to the Owner and the Design Professional a milestone schedule for completing the Work within the Contract Time. Such schedule shall be in a form specified in Division 1 of the Specifications and be acceptable to the Owner and to the Design Professional. The schedule must be submitted to and accepted by the Design Professional prior to the first request for payment unless required earlier by Division 1 of the Specifications. The Contractor's milestone schedule must be updated as required by the Design Professional and/or the Owner to reflect conditions encountered and shall apply to the total Project. The Contractor's revisions to the schedule shall not constitute a waiver of the requirement to complete the Project in the time allowed by the Contract unless additional time for performance has been allowed pursuant to a Change Order. Any changes in milestone start or end dates must be furnished to the Owner and the Design Professional. Strict compliance with the requirements of this Paragraph shall be a condition precedent to the payment to the Contractor and failure by the Contractor to strictly comply with said requirements shall constitute a material breach of this Contract.
- 10.12** Unless otherwise provided in the Contract Documents, on all projects where the Fixed Price Contract Amount is over \$1,000,000, the Contractor shall schedule and perform the Work in accordance with a Critical Path Method ("CPM") to indicate the rate of progress and practical order of the Project. The purpose of this scheduling requirement is to ensure adequate planning, coordination, and execution of the Work. The schedule shall indicate the dates for starting and completing major Work activities, project events, major equipment, material and equipment submittals and delivery of major items. Project activities having critical time restraints on action, required by the Owner, shall be shown as scheduled milestones. The Contractor's schedule shall demonstrate the order, interdependence, and sequence of activities. Critical paths shall be highlighted or distinguished. The schedule shall include all the dates specified in the Contract for Substantial Completion and final completion of the Work. The time limit set forth in the Contract for Substantial Completion and final completion must govern; the schedule must be adjusted to meet these dates. Schedule float shall belong to the Project. The Contractor shall submit to the Owner and Design Professional a CPM schedule within three (3) weeks after award of the

Contract and maintain such schedule on a current basis in accordance with the Contract Documents.

- 10.13** Once a month, or at intervals as required by the Design Professional, the Contractor shall advise the Owner and the Design Professional of the status of the Work (in duplicate) on the current milestone schedule. If any project milestone dates are not met on schedule, the Contractor shall immediately advise the Owner and Design Professional in writing of the proposed action to bring the Work on schedule. The Contractor shall also submit a detailed short-term schedule, as required by Division 1 of the Specifications, each month. This short-term schedule shall include a description of current and anticipated problem areas, delaying factors and their impact, and explanation of corrective action taken or proposed. If the Work is behind schedule, the Contractor shall indicate what measures it will take to put the Work back on schedule.
- 10.14** If the Work is not progressing through no fault of the Owner or the Design Professional, as shown on the milestone schedule, as determined by the Design Professional, and the Owner and the Design Professional do not believe the Contractor's proposed action to bring the Work on schedule is adequate, then the Contractor shall be deemed in default under this Contract and the progress of the Work shall be deemed unsatisfactory. In such event, the Owner, at its discretion, may require the Contractor to Work such additional time over regular hours, including Saturdays, Sundays, and holidays, without additional cost to the Owner to bring the Work on schedule.
- 10.15** The Contractor shall keep an updated copy of the Drawings and Project Manual (including Specifications) and Addenda at the site. Additionally, the Contractor shall keep a current submittal schedule and a copy of approved shop drawings and other submittals. All these items shall be available to the Owner and the Design Professional at all regular business hours. Upon final completion of the Work, all these items must be updated by the Contractor and provided to the Design Professional and shall become the property of the Owner.
- 10.16** The Contractor shall carefully review and inspect for compliance with the Contract Documents, the shop drawings, and other submittals (including product data and samples) required by the Contract Documents and shall submit to the Design Professional only submittals approved in accordance with this section. Such review and submittal shall be done promptly and in a sequence that will not delay its Work under this Contract or the activities of the Owner or of separate contractors. Shop drawings and other submittals from the Contractor do not constitute a part of the Contract. The Contractor shall not do any Work requiring shop drawings or other submittals unless the Design Professional has verified compliance in writing. All Work requiring verified shop drawings or other submittals shall be done in strict compliance with such approved documents. However, verification of compliance by the Design Professional shall not be evidence that Work installed pursuant thereto conforms with the requirements of this Contract. The Design Professional shall have no duty to review submittals that are not Contractor approved, partial submittals or incomplete submittals. The Contractor shall maintain a submittal log which shall include, at a minimum, the date of each submittal, the date of any re-submittal, the date of any approval or rejection and the reason for any rejection.
- 10.17** The Contractor shall maintain the Project site in a reasonably clean condition during performance of the Work. Upon final completion, the Contractor shall thoroughly clean the Project site of all debris, trash and excess materials or equipment.

- 10.18** At all times relevant to this Contract, the Owner and the Design Professional shall have a right to enter the Project site and the Contractor shall allow the Owner and/or the Design Professional to review or inspect the Work without formality or other procedure.
- 10.19** The presence or duties of the Design Professional's or the Owner's personnel or representatives at the construction site, does not make any of them responsible for those duties that belong to the Contractor or other entities and does not relieve the Contractor or any other entities of their obligations, duties, and responsibilities, including any obligation or requirement to have or to implement any health or safety plans or precautions. Except as provided in Paragraph 10.9, Design Professional's and Owner's personnel have no authority to exercise any control over any Contractor or other entities or their employees in connection with their Work or any health or safety precautions and have no duty for inspecting, noting, observing, correcting, or reporting on health or safety deficiencies of the Contractor or other entities or any other persons at the site except their own personnel. The presence of Design Professional's or Owner's personnel at a construction site is for the purpose of providing to Owner a greater degree of confidence that the completed Work will conform to the Contract Documents and that the integrity of the design concept as reflected in the Contract Documents has been implemented and preserved by the Contractor. Construction sites include places of manufacture for materials incorporated into the construction Work and Contractor includes manufacturers of materials incorporated into the construction Work.

ARTICLE 11

SAVE HARMLESS AND INDEMNIFICATION

- 11.1** The Contractor shall indemnify, defend and hold harmless the State of Idaho, Division of Public Works, its officers, agents, employees, from and against all liability, claims, damages, losses, expenses, actions, settlements, attorneys' fees, and suits whatsoever caused by, arising out of, or in connection with Contractor's acts or omissions under this Agreement or the Contractor's failure to comply with any State or federal statute, law, regulation, or rule.
- 11.2** Upon receipt of the State's tender of indemnity and defense, Contractor shall immediately take all reasonable actions necessary, including, but not limited to providing a legal defense for the State, to begin fulfilling its obligation to indemnify, defend, and save harmless the State. Contractor's indemnification and defense liabilities described herein shall apply regardless of any allegations that a claim or suit is attributable in whole or in part to any act or omission of the State under this Agreement. Contractor shall not be required to hold the State harmless for damages attributed to the State in a final order issued by a court of competent jurisdiction.
- 11.3** Any legal defense provided by the Contractor to the State under this Section must be free of any conflicts of interest, even if retention of separate legal counsel for the State is necessary. Any attorney appointed to represent the State must first qualify as and be appointed by the Attorney General of the State of Idaho as a Special Deputy Attorney General pursuant to Idaho Code sections 67-1401(13) and 67-1409(1). The State must approve all settlement offers and agreements made on its behalf and has the option to attend any settlement or alternative dispute resolution proceedings.

ARTICLE 12

THE DESIGN PROFESSIONAL

12.1 The Design Professional for this Project is identified in Exhibit B, incorporated herein by reference, along with any authorized representatives and any limitations of responsibility. For the purpose of this Contract, the “Design Professional” means the properly licensed architect, properly registered professional engineer or other professional licensed in the State of Idaho who prepared the Drawings and Specifications for this Project. If the employment of the Design Professional is terminated, the Owner may retain a replacement professional, and the role of the replacement professional shall be the same as the role of the Design Professional. Unless otherwise directed by the Owner in writing, the Design Professional will perform those duties and discharge those responsibilities allocated to the Design Professional in this Contract. The duties, obligations and responsibilities of the Design Professional shall be for contract administration and include the following:

- (a) Unless otherwise directed by the Owner in writing, the Design Professional shall not act as the Owner's agent.
- (b) Unless otherwise directed by the Owner in writing, the Owner and the Contractor shall communicate with each other through the Design Professional.
- (c) When requested by the Owner or Contractor in writing, the Design Professional shall within seven (7) days render written interpretations necessary for the proper execution or progress of the Work or shall provide a written explanation as to why more time is needed and provide a date by which it will be provided.
- (d) The Design Professional shall draft proposed change authorization(s).
- (e) The Design Professional shall review and verify compliance or respond otherwise as necessary concerning shop drawings or other submittals received from the Contractor.
- (f) The Design Professional shall be authorized to refuse to accept Work that is defective or otherwise fails to comply with the requirements of this Contract. If the Design Professional deems it appropriate, the Design Professional may, with the Owner's consent, require extra inspections or testing of the Work for compliance with the requirements of this Contract.
- (g) The Design Professional shall review the Contractor's Request for Payment and shall verify in writing those amounts which, in the opinion of the Design Professional, are properly owing to the Contractor as provided in this Contract.
- (h) The Design Professional shall, upon written request from the Contractor, perform Substantial Completion and final completion inspections contemplated by Article 6.
- (i) The Design Professional may require the Contractor to make changes which do not involve a change in the Fixed Price Construction Contract Amount or time consistent with the intent of this Contract. Such changes shall be given to the Contractor in writing under signature of the Design Professional, with a copy to the Owner, and may be in the form of a supplemental instruction.
- (j) The Design Professional shall review and evaluate Objections and take other actions related to Claims in accordance with Articles 13, 14, and 16.

- (k) The duties, obligations and responsibilities of the Contractor under this Contract shall in no manner whatsoever be changed, altered, discharged, released, or satisfied by any duty, obligation, or responsibility of the Design Professional. The Contractor is not a third-party beneficiary of any Contract by and between the Owner and the Design Professional. It is expressly acknowledged and agreed that the duties of the Contractor to the Owner are independent of, and are not diminished by, any duties of the Design Professional to the Owner.

ARTICLE 13

OWNER'S NOTIFICATION TO CONTRACTOR OF NON-CONFORMING WORK

- 13.1** The Owner, Owner's Representative, or the Design Professional shall notify the Contractor of non-conforming work, which shall include work that deviates from the Contract Documents ("Non-Conforming Work"). Non-Conforming Work shall be determined in the sole discretion of the Owner or Design Professional. The notice shall be in writing or verbally at the regular construction progress meetings as soon as reasonably practicable and documented in the minutes.
- 13.2** This section shall not limit the Owner's remedies under this Agreement.
- 13.3** Contractor shall fix Non-Conforming Work to Owner's satisfaction, or the Contractor may file an Objection pursuant to the requirements in Article 14.
- 13.4** The Contractor must demonstrate to Owner, Owner's Representative or the Design Professional that Non-Conforming work has been corrected prior to covering or concealing the work.

ARTICLE 14

CONTRACTOR'S OBJECTIONS

- 14.1** For purposes of this Contract, an "Objection" means a demand by the Contractor to the Owner or Design Professional for a change in the Fixed Price Contract Amount, an extension of the Contract Time, an adjustment to or interpretation of the Contract terms, change to Contract Documents, or other relief with respect to the terms of the Contract, which demand the Contractor or Owner asserts is required or allowed under the Contract Documents and which the Contractor and the Owner, or Contractor and Design Professional have previously discussed and failed to agree upon.
- 14.2** For the Objection to be considered, it must meet the following requirements:
- (a) The Objection must be in writing;
 - (b) The Objection by the Contractor must be signed by an authorized representative of the Contractor;
 - (c) The Objection by the Contractor must be provided to the Owner and to the Design Professional;
 - (d) The Objection must be made no later than ten (10) days after the event or first appearance of the circumstance giving rise to the Objection;

- (e) The Objection must describe in detail all known facts and circumstances that the Contractor asserts support the Objection;
- (f) The Objection must refer to the provision(s) of the Contract Documents that the Contractor asserts support the Objection;
- (g) The Contractor must provide all documentation or other information to substantiate the Objection; and
- (h) The Contractor must continue its performance under this Contract pending the resolution of any Objection; provided, however, that the Contractor shall not perform any additional or changed work not otherwise authorized in accordance with the Contract Documents.

14.3 The failure by the Contractor to meet any of the requirements of Paragraph 14.2 shall constitute a complete waiver by the Contractor of any rights arising from or related to the Objection.

14.4 If the Objection is made based on concealed or unknown site conditions, the following shall apply in addition to all other provisions applicable to the Objection:

- (a) The condition must have been previously concealed and unknown or of a type not ordinarily encountered in the general geographic location of the Project and must not have been reasonably susceptible to discovery; and
- (b) The Contractor shall notify the Design Professional and the Owner of the condition and shall not disturb the condition until the Design Professional and Owner have observed it or have waived in writing the right to observe it.

14.5 If the Objection by the Contractor is for an increase in the Fixed Price Contract Amount, the following shall apply in addition to all other provisions applicable to the Objection:

- (a) Any increase in the Fixed Price Contract Amount shall be strictly limited to the direct costs incurred by the Contractor and shall not include any other costs, indirect or other, including any costs for or related to lost productivity, profit, home office overhead and any other overhead, legal fees, Objection preparation, any matter previously resolved by a change order, equipment costs, costs related to the services of a project manager unless the project manager was required full time by the Owner or the Contract Documents, any costs associated with the failure to complete the Work early or in advance of the date required by the Contract Documents, it being specifically agreed to by the parties that there is no intention to have the Eichleay or other similar formula applicable to this Contract nor shall this Contract be deemed to be subject to any such formula; and
- (b) The Owner shall have no liability for, and the Fixed Price Contract Amount shall not be increased related to, any Objections of third parties, including subcontractors, unless and until the liability of the Contractor for such has been established in a court of competent jurisdiction and any such liability of the Owner shall be limited in the same manner as described in subparagraph 14.5 (a).

14.6 If the Objection by the Contractor is for an extension of the Contract Time, the following shall apply in addition to all other provisions applicable to the Objection:

- (a) The Contractor has been delayed in its performance by an act or omission of the Owner and through no fault of the Contractor;
- (b) The Contractor has been delayed in its performance by unusually severe weather that could not reasonably have been anticipated or by another event not within its reasonable control;
- (c) At the time it occurs or during its occurrence, the delay will preclude completion of the Project in the time required by the Contract Documents; and
- (d) Any extension of the Contract Time shall be the Contractor's sole and exclusive remedy for any delay except a delay caused by the active interference of the Owner with the Contractor's performance which active interference continues after written notice to the Owner. The Owner's exercise of any of its rights or remedies under this Contract, including ordering changes in the Work, directing suspension, rescheduling or correction of the Work, do not constitute active interference.

14.7 If an Objection is made based on an error, inconsistency or omission in the Contract that was reasonably susceptible to discovery by the Contractor and was not reported, then that Objection shall be denied.

14.8 All Objections made in accordance with this Article 14 shall be reviewed and evaluated by the Design Professional. If the Objection is not made in strict accordance with Article 14, it shall be rejected as waived. Any failure by the Design Professional to reject the Objection for failure to meet the requirements of Article 14 is not binding on the Owner and the Owner may reject the Objection for such failure.

14.9 No later than seven (7) days from receipt of the Objection by the Design Professional, they may either:

- (a) Make a written request to the Contractor or Owner for more data to support the Objection if desired;
- (b) Attempt to facilitate resolution of the Objection through informal negotiations; or
- (c) Make a written recommendation to the Owner, with a copy to the Contractor, that the Owner reject or approve all or part of the Objection and state the reasons for the Design Professional's recommendation.

14.10 If the Design Professional requests more data from the Contractor under subparagraph 14.9.(a), the Contractor shall respond no later than seven (7) days from receipt of such request, and provide additional data, provide a date certain by which additional data will be provided, or state that it will not provide additional data. Upon receipt of data, if any, in accordance with this section, the Design Professional will complete the evaluation of the Objection within seven days. Failure to respond at all or failure to provide data by the date specified in the response to the request shall result in the Objection being evaluated based on the information in the Design Professional's possession.

- 14.11** In evaluating the Objection, the Design Professional may consult with the Contractor, the Owner or other persons with knowledge or expertise that may assist the Design Professional in its evaluation.
- 14.12** No later than fourteen (14) days after receipt by the Owner of the Design Professional's recommendation regarding the Contractor's Objection, the Owner shall, in writing, notify the Contractor and the Design Professional of its decision regarding the Objection.
- 14.13** The Owner's decision regarding the Contractor's Objection is binding on final between the Owner and the Contractor but is subject to mediation in accordance with this Contract. The Contractor must proceed with the Work under the terms of this Agreement and any decision made by the Owner pursuant to this Section; provided, however, that Contractor but may concurrently pursue any remedies available at law or under this Contract.

ARTICLE 15

SUBCONTRACTORS

- 15.1** A document in the form of Exhibit E shall be completed and submitted upon execution of this Contract and those subcontractors named therein shall match those subcontractors named in the Contractor's bid unless otherwise agreed to in writing by the Owner. Also, upon execution of this Contract by the Contractor, the Contractor shall identify to the Owner and the Design Professional, in writing, those parties intended as subcontractors on the Project not otherwise named in Exhibit E. The Owner shall, in writing, state any objections the Owner may have to one or more of such subcontractors. The Contractor shall not enter into a subcontract with an intended subcontractor with reference to whom the Owner objects. All subcontracts shall afford the Contractor rights against the subcontractor which correspond to those rights afforded to the Owner against the Contractor herein, including those rights of Contract Termination as set forth in this Contract. All subcontractors shall, throughout the duration of this Contract, be properly licensed as Idaho Public Works Contractors.
- 15.2** The Contractor conditionally assigns each of its subcontracts related to the Project to the Owner. All subcontracts between the Contractor and the subcontractors shall obligate the subcontractor to such conditional assignment. Upon a Termination by the Owner for cause under Paragraph 20.1, the Owner may accept such conditional assignment by written notification to the applicable subcontractor and to the Contractor. Such acceptance is subject to the rights of the Surety, if any, relating to the Contract.

ARTICLE 16

CHANGES IN THE WORK

- 16.1** General:
- (a) Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive, or order for a minor change in the Work, subject to the limitations stated in this Article and elsewhere in the Contract Documents; and

- (b) Changes in the Work shall be performed under applicable provisions of the Contract Documents and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

16.2 Change Orders:

- (a) “Change Order” is a written instrument prepared by the Design Professional and signed by the Owner, Contractor and Design Professional, stating their agreement upon: a change in the Work, any adjustment in the Fixed Price Contract Amount and any adjustment in the Contract Time;
- (b) Methods used in determining adjustments to the Fixed Price Contract Amount may include those listed in subparagraph 16.3.(d);
- (c) The amount allowed for overhead and profit on any Change Order is limited to the amounts indicated in subparagraph 16.3.(k);
- (d) Any Change Order prepared, including those arising by reason of the parties’ mutual agreement or by mediation, shall constitute a final and full settlement of all matters relating to or affected by the change in the Work, including all direct, indirect, and consequential costs associated with such change and any and all adjustments to the Fixed Price Contract Amount and Contract Time. In the event a Change Order increases the Fixed Price Contract Amount, the Contractor shall include the Work covered by such Change Order in the Contractor’s Request for Payment as if such Work were originally part of the Project and Contract Documents; and
- (e) By the execution of a Change Order, the Contractor agrees and acknowledges that it has had sufficient time and opportunity to examine the change in Work which is the subject of the Change Order and that it has undertaken all reasonable efforts to discover and disclose any concealed or unknown conditions which may to any extent affect the Contractor’s ability to perform in accordance with the Change Order. Aside from those matters specifically set forth in the Change Order, the Owner shall not be obligated to make any adjustments to either the Fixed Price Contract Amount or Contract Time by reason of any conditions affecting the change in Work addressed by the Change Order, which could have reasonably been discovered or disclosed by the Contractor’s examination.

16.3 Construction Change Directive (CCD):

- (a) “Construction Change Directive” is a written order prepared by the Design Professional and signed by the Owner and Design Professional directing a change in the Work prior to agreement on adjustment, if any, in the Fixed Price Contract Amount or Contract Time or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract, consisting of additions, deletions or other revisions, the Fixed Price Contract Amount and Contract Time being adjusted accordingly;
- (b) A Construction Change Directive, within limitations, may also be used to incorporate minor changes in the Work agreed to by the Design Professional’s representative, the Owner’s Field Representative and the Contractor’s superintendent or project manager. The

limits of these representatives' authority with regard to Construction Change Directives shall be documented in writing by the Design Professional, Owner and Contractor;

- (c) A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order;
- (d) If the Construction Change Directive provides for an adjustment to the Fixed Price Contract Amount, the adjustment shall be based on one (1) of the following methods:
 - i. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
 - ii. Unit prices stated in the Contract Documents or subsequently agreed upon;
 - iii. Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
 - iv. As provided in subparagraph 16.3.(g).
- (e) Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Design Professional in writing within forty-eight (48) hours of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Fixed Price Contract Amount or Contract Time;
- (f) A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Fixed Price Contract Amount and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be incorporated into a future Change Order;
- (g) If the Contractor does not respond promptly or disagrees with the method for adjustments in the Fixed Price Contract Amount or Contract Time, the method and the adjustment shall be determined by the Design Professional on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Fixed Price Contract Amount, an allowance for overhead and profit in accordance with subparagraph 16.3.(k). In such case of an increase in Fixed Price Contract Amount, and also under subparagraph 16.3.(d), the Contractor shall keep and present, in such form as the Design Professional may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this subsection shall be limited to the following:
 - i. Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom and Workers' compensation insurance;
 - ii. Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
 - iii. Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

- iv. Costs of permit fees and sales, use or similar taxes related to the Work; and
 - v. Additional costs of supervision and field office personnel directly attributable to the change.
- (h) The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Fixed Price Contract Amount shall be for the actual net cost of the decrease, confirmed by the Design Professional. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change;
- (i) Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in the Contractor's Request for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs;
- (j) When the Owner and Contractor agree with the determination by the Design Professional concerning the adjustments in the Fixed Price Contract Amount and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order; and
- (k) For purposes of subparagraphs 16.2.(c) and 16.3.(g), the allowance for combined overhead, profit, bonds and insurance shall be limited as follows, unless otherwise provided in the Contract Documents:
- i. For changes, the amount allowed for overhead, profit, bonds and insurance for the Contractor and all subcontractors of any tier combined shall not exceed fifteen percent (15%) of direct costs; or
 - ii. The Contractor will determine the apportionment between the Contractor and its subcontractors of allowable amounts of overhead, profit, bonds, and insurance.

16.4 The Design Professional will have authority to order minor changes in the Work not involving adjustment in the Fixed Price Contract Amount or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall occur by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 17

DISCOVERING AND CORRECTING DEFECTIVE OR INCOMPLETE WORK

17.1 If the Contractor covers, conceals, or obscures its Work in violation of this Contract or in violation of a directive or request from the Owner or the Design Professional, such Work shall be uncovered and displayed for the Owner's or Design Professional's inspection upon request and shall be reworked at no cost in time or money to the Owner.

- 17.2** If any of the Work is covered, concealed, or obscured in a manner not addressed by Paragraph 17.1, it shall, if directed by the Owner or the Design Professional, be uncovered and displayed for the Owner's or Design Professional's inspection. If the uncovered Work conforms strictly with this Contract, the costs incurred by the Contractor to uncover and subsequently replace such Work shall be borne by the Owner. Otherwise, such costs shall be borne by the Contractor.
- 17.3** The Contractor shall, at no cost in time or money to the Owner, promptly correct Work (fabricated, installed or completed) rejected by the Owner or by the Design Professional as defective or that fails to conform to this Contract whether discovered before or after Substantial Completion. Additionally, the Contractor shall reimburse the Owner for all testing, inspections and other expenses incurred as a result thereof.
- 17.4** In addition to any other warranty obligations in this Contract, the Contractor shall be specifically obligated to correct, upon written direction from the Owner, any and all defective or nonconforming Work for a period of twelve (12) months following Substantial Completion.
- 17.5** The Owner may, but shall in no event be required to, choose to accept defective or nonconforming Work. In such event, the Fixed Price Contract Amount shall be reduced by the lesser of:
- (a) the reasonable costs of removing and correcting the defective or nonconforming Work; or
 - (b) the difference between the fair market value of the Project as constructed and the fair market value of the Project had it not been constructed in such a manner as to include defective or nonconforming Work. If the remaining portion of the unpaid Fixed Price Contract Amount, if any, is insufficient to compensate the Owner for the acceptance of defective or nonconforming Work, the Contractor shall, upon written demand from the Owner, pay the Owner such remaining compensation for accepting defective or nonconforming Work.

ARTICLE 18

TERMINATION BY THE CONTRACTOR

- 18.1** The Contractor may terminate the Contract if the Work is stopped for a period of ninety (90) consecutive days through no act or fault of the Contractor or a subcontractor, sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:
- (a) Issuance of an order by a court or by another public authority having jurisdiction and authority which requires all Work to be stopped; or
 - (b) An act of government, such as a declaration of national emergency, which requires all Work to be stopped.
- 18.2** In such event, the Contractor shall be entitled to recover from the Owner as though the Owner had terminated the Contractor's performance under this Contract pursuant to Paragraph 20.3.

ARTICLE 19

OWNER'S RIGHT TO SUSPEND CONTRACTOR'S PERFORMANCE

- 19.1** The Owner may, at any time and without cause, order the Contractor, in writing, to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine. If the Owner directs any such suspension, the Contractor must immediately comply with same.
- 19.2** In the event the Owner directs a suspension of performance under this Article, and such suspension is through no fault of the Contractor, the Fixed Price Contract Amount and Contract Time shall be adjusted for increases in the cost and time caused by such suspension, delay, or interruption to cover the Contractor's reasonable costs, actually incurred and paid, of:
- (a) Demobilization and remobilization, including such costs paid to subcontractors;
 - (b) Preserving and protecting Work in place;
 - (c) Storage of materials or equipment purchased for the Project, including insurance thereon; and
 - (d) Performing in a later, or during a longer, time frame than that provided by this Contract.
- 19.3** The adjustment of the Fixed Price Contract Amount shall include an amount for a reasonable profit. The adjustment of the Fixed Price Contract Amount shall not include any amount not otherwise allowed under this Contract, including any limitations applicable to Claims. The Contractor shall provide supporting documentation related to any increase upon request of the Owner. No adjustment shall be made to the extent:
- (a) That performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
 - (b) That an equitable adjustment is made or denied under another provision of the Contract.

ARTICLE 20

TERMINATION BY THE OWNER

The Owner may terminate this Contract in accordance with the following terms and conditions:

- 20.1** If the Contractor does not perform the Work, or any part thereof, in accordance with the Contract Documents, or in a timely manner; does not supply adequate labor, supervisory personnel, or proper equipment or materials; fails to pay subcontractors; fails to timely discharge its obligations for labor, equipment, and materials; proceeds to disobey applicable law; or otherwise breaches this Contract, then the Owner, in addition to any other rights it may have against the Contractor, may terminate the Contract and assume control of the Project site and of all materials and equipment at the site and may complete the Work. In such case, the Contractor shall not be paid further until the Work is complete. Upon such Termination, the Owner may, subject to any superior rights of the Surety, take possession of the site and of all materials, equipment, tools and construction equipment and machinery thereon owned by the Contractor; accept assignment of those subcontracts conditionally assigned under Paragraph 15.2; and finish the Work by whatever reasonable method the Owner may deem expedient.
- 20.2** When the Owner terminates the Contract for cause as provided in Paragraph 20.1, the Contractor shall not be entitled to receive further payment until the Work is finished and shall only be entitled

to payment for Work satisfactorily performed by the Contractor in accordance with the Contract Documents. If the costs of finishing the Work, including compensation for the Design Professional's services and expenses made necessary thereby, exceed the unpaid balance, the Contractor shall pay the difference to the Owner. This obligation for payment shall survive termination of the Contract. The Contractor shall also terminate outstanding orders and subcontracts. The Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders. In the event the employment of the Contractor is terminated by the Owner for cause pursuant to Paragraph 20.1 and it is subsequently determined by a court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a Termination under Paragraph 20.3 and the provisions of Paragraph 20.3 shall apply.

20.3 The Owner may, at any time and for any reason, terminate this Contract. The Owner shall give no less than seven (7) days' written notice of such Termination to the Contractor specifying when termination becomes effective. The Contractor shall incur no further obligations in connection with the Work and the Contractor shall stop Work when such Termination becomes effective. The Contractor shall also terminate outstanding orders and subcontracts. The Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders. The Owner may direct the Contractor to assign the Contractor's right, title and interest under termination orders or subcontracts to the Owner or its designee. The Contractor shall transfer title and deliver to the Owner such completed or partially completed Work and materials, equipment, parts, fixtures, information, and Contract rights as the Contractor has. When terminated pursuant to this section, the following shall apply:

- (a) The Contractor shall submit a Termination Claim to the Owner and the Design Professional specifying the amounts claimed due because of the Termination, together with costs, pricing or other supporting data required by the Owner or the Design Professional. Failure by the Contractor to file a Termination Claim within ninety (90) days from the effective date of termination shall be deemed a complete waiver by the Contractor of any right to any payment;
- (b) Before or after receipt of the Termination Claim, the Owner and the Contractor may agree to the compensation, if any, due to the Contractor hereunder; and
- (c) If the Contractor has filed the Termination Claim but the Contractor and the Owner do not agree on an amount due to the Contractor, the Owner shall pay the Contractor the following amounts:
 - i. Unpaid Contract prices for labor, materials, equipment and other services provided or perfected prior to termination and acceptable to or accepted by the Owner;
 - ii. Reasonable costs incurred in preparing to perform the terminated portion of the Work, and in terminating the Contractor's performance, plus a fair and reasonable allowance for direct job-site overhead and profit related to such preparation (such profit shall not include anticipated profit or consequential damages); provided, however, that if it appears that the Contractor would have not profited or would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated loss, if any; and

- iii. Reasonable costs of settling and paying claims arising out of the Termination of subcontracts or orders pursuant to this Paragraph 20.3.

20.4 Costs described in subparagraphs 20.3.(c)(ii) or 20.3.(c)(iii) above shall not include amounts paid in accordance with other provisions hereof. In no event shall the total sum to be paid the Contractor under subparagraph 20.3.(c) exceed the total Fixed Price Contract Amount, as properly adjusted, reduced by the amount of payments previously or otherwise made and by any other deductions permitted under this Contract and shall in no event include duplication of payment.

ARTICLE 21

CONTRACTOR'S LIABILITY INSURANCE

21.1 All insurance carriers providing coverage under this Agreement, shall be rated an "A" or above by Best's Insurance Rating Service. Evidence of such insurance coverage or self-insurance shall be in the form of a certificate of insurance or statement of financial responsibility. The Contractor shall immediately notify the Owner of notice of knowledge of cancellation, refusal to renew, or change in any material way the nature or extent of the coverage provided by such policies. The Contractor will provide notification by written notice, by certified or registered mail, return receipt requested.

21.2 Contractor shall maintain such Commercial General Liability insurance with minimum limits of \$1,000,000/\$2,000,000 to protect its interest and that of the Owner. Unless Contractor's Commercial General Liability insurance covers its Sub-Contractors, each Sub-Contractor shall maintain such Commercial General Liability Insurance with minimum limits of \$1,000,000. The State of Idaho, Division of Public Works, and Idaho State University will be named an Additional Insured on any general liability and property policies carried and required by this Agreement. The insurance afforded by the Contractor and Sub-Contractors shall be primary insurance. The State of Idaho's retained risk program coverage is only applicable to the acts or omissions of the State's officials, agents, or employees and shall not cover the acts or omissions of the Contractor or its Sub-Contractors.

21.3 Contractor shall carry Worker's Compensation Insurance to cover obligations imposed by federal and state statutes covering all employees and employers' liability insurance with a minimum limit of 1,000,000.

21.4 Business Auto and Umbrella Liability Insurance: Contractor shall maintain business, auto liability and, if necessary, commercial umbrella liability insurance with a limit of not less than \$1,000,000 each accident;

Such insurance shall cover liability arising out of any auto (including owned, hired, and non-owned autos);

Business auto coverage shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01;

If hazardous waste will be hauled, Contractor shall obtain pollution liability coverage equivalent to that provided under the ISO pollution liability-broadened coverage for covered autos endorsement (CA 99 48) and the Motor Carrier Act endorsement (MCS 90) shall be attached.

21.5 If any of the insurance required under this Agreement is arranged on "claims made" basis, "tail" coverage will be required at the completion of this Agreement for duration of five (5) years thereafter. The Contractor shall be responsible for furnishing certification of "tail" coverage or

continuous “claims made” liability coverage for five (5) years following the completion of this Agreement. Continuous “claims made” coverage will be acceptable in lieu of “tail” coverage provided its retroactive date is on or before the effective date of this Agreement.

21.6 The Contractor shall indemnify, defend and save harmless the State of Idaho, the Division of Public Works, Idaho State University, their officers, agents and employees, from and against any liability, claims, damages, losses, expenses, actions and suits whatsoever, including injury or death of others or any employees of the Contractor or the Contractor’s Sub-Contractor caused by or arising out of acts or omissions, or negligent performance by the Contractor of any term of this contract.

21.7 All express representations, indemnifications or limitations of liability made in or given to this Agreement will survive the completion of all services of Contractor under this Agreement or the termination of this Agreement for any reason.

21.8 Risk Table

Estimated Project Construction Cost	General Contractor / CM @ Risk General Liability Requirement
Less than \$10,000,000	\$1,000,000 Per Occurrence \$2,000,000 General Aggregate \$2,000,000 Products/Completed Operations Aggregate
\$10,000,000 to \$29,999,999	\$5,000,000 Per Occurrence \$5,000,000 General Aggregate \$5,000,000 Products/Completed Operations Aggregate
\$30,000,000 to \$49,999,999	\$10,000,000 Per Occurrence \$10,000,000 General Aggregate \$10,000,000 Products/Completed Operations Aggregate
\$50,000,000 to \$100,000,000	\$25,000,000 Per Occurrence \$25,000,000 General Aggregate \$25,000,000 Products/Completed Operations Aggregate
Over \$100,000,000	Limits and type of Insurance program to be determined. Contact Risk Management

Note: If the total project value exceeds \$10,000,000, the above appropriate limits should replace the standard \$1,000,000/\$2,000,000 requirements, as applicable.

Specific Insurance Minimum Requirements for Personal Injury, Fire Damage and Medical Payments: Contractor shall provide coverage with limits for Personal Injury, Fire Damage and Medical Payments not less than those stated below.

Minimum Limits (Any Project under \$10,000,000)	Personal /Advertising Injury - \$1,000,000 Fire Damage (Any one fire) \$50,000 Medical Payments (Any one person) \$5,000

Project Cost of \$10,000,000 to \$29,999,999	Personal /Advertising Injury - \$5,000,000 Fire Damage (Any one fire) \$50,000 Medical Payments (Any one person) \$5,000
Project Cost of \$30,000,000 to \$49,999,999	Personal /Advertising Injury - \$10,000,000 Fire Damage (Any one fire) \$50,000 Medical Payments (Any one person) \$5,000
Project cost 50,000,000-\$100,000,000	Personal /Advertising Injury - \$25,000,000 Fire Damage (Any one fire) \$50,000 Medical Payments (Any one person) \$5,000

ARTICLE 22

BUILDER'S RISK INSURANCE

22.1 Unless otherwise provided in this Agreement, the General Contractor shall purchase or maintain property insurance written on a builder's risk "all-risk" policy (the "Builder's Risk Policy") in excess of **WRITE OUT AMOUNT [\$000.000 Total Contract Sum]** to cover the Owner's property, the Project, and General Contractor's equipment, materials, and supplies.

(a) The Builder's Risk Policy shall:

- i. Include perils of fire with extended coverage and mischief, collapse, earthquake, flood, windstorm, temporary buildings and debris removal, demolition, and flood damage, if commercially available for similar operation in the region of the United States where the Project is located;
- ii. Be of an amount not less than the initial Contract Amount, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site, on a replacement cost basis without optional deductibles;
- iii. Cover resultant damage from errors in design, plans, specifications, faulty workmanship, materials, and construction;
- iv. Include reasonable compensation for Design Professional, Project Manager, Owner and its contractors' services and expenses required as a result of an insured loss, excluding any Liquidated Damages, extra expense, and expediting expense;
- v. Include the State of Idaho, Contractor and Sub-Contractors as Named Insureds under the policy.
- vi. Contain an express, full and complete, waiver of any right of subrogation by the insurer in favor of the Owner and State of Idaho for loss or damage occurring during the Work to the extent covered by the Builder's Risk Policy.

(b) The General Contractor shall purchase the Builder's Risk Policy from a company or companies lawfully authorized to do business and issues contracts of insurance in the State of Idaho.

(c) The General Contractor shall be responsible for the deductible, whether or not to the extent the loss is caused by the negligence or intentional misconduct of the General Contractor, any of its Subcontractors or sub-subcontractors or material suppliers or any other person for whom the General Contractor is responsible.

- (d) The General Contractor shall submit to the Owner, or the Project Manager if designated by the Owner, for its approval, all items deemed by the Builder's Risk Policy carrier to be uninsurable.
- (e) The General Contractor shall not commence Work under the Agreement until it has obtained all required insurance and until evidence of the required insurance has been reviewed and accepted by the Owner. Owner review of the insurance shall not relieve nor decrease the liability of the General Contractor.
- (f) The Builder's Risk Policy shall be maintained in force, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final acceptance by the Owner and final payment to the General Contractor has been made.

22.2 The Contractor authorizes the Owner to negotiate and agree on the value and extent of, and to collect the proceeds payable with respect to, any loss under a policy of insurance where the Owner is the Insured or Additional Insured pursuant to any of the provisions of this Article. The Owner shall have full right and authority to compromise any claim, or to enforce any claim by legal action or otherwise, or to release and discharge any insurer, by and on behalf of the Owner and Contractor. The Owner shall provide written notice to Contractor of:

- (a) its having reached any such settlement or adjustment with an insurer; and
- (b) the receipt of any funds pursuant to this Article. Any objection by the Contractor to a settlement or adjustment made under this Article must be made in writing to the Owner within five (5) business days of the notice from the Owner. The Owner and the General Contractor agree to attempt to resolve the dispute by mutual agreement.

22.3 The General Contractor shall deposit proceeds received under the Builder's Risk Policy in a manner in which such proceeds can be separately accounted for. The General Contractor shall distribute the proceeds in accordance with an agreement as the parties may reach. If after such loss no other special agreement is made and unless the Owner terminates the Contract pursuant to Article 20, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 16.

ARTICLE 23
SOVEREIGN IMMUNITY

- 23.1** In no event shall this Agreement or any act by the STATE OF IDAHO, be a waiver of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. If a claim must be brought in a federal forum, then it must be brought and adjudicated solely and exclusively within the United States District Court for the State of Idaho. This Section applies to a claim brought against the STATE OF IDAHO only to the extent Congress has appropriately abrogated the state's sovereign immunity, and is not consent by the STATE OF IDAHO, to be sued in federal court, or a waiver of any form of immunity, including, but not limited to, sovereign immunity, and immunity based on the Eleventh Amendment to the Constitution of the United States.

ARTICLE 24
PERFORMANCE AND PAYMENT BONDS

- 24.1** The Contractor shall furnish separate performance and payment bonds to the Owner. Each bond shall set forth a penal sum in an amount not less than the Fixed Price Contract Amount and shall include a power of attorney attached to each bond. The signature of both the Contractor's principal and the Surety are required. If the Surety is incorporated, both bonds must have the corporate seal. Each bond furnished by the Contractor shall incorporate by reference the terms of this Contract as fully as though they were set forth verbatim in such bonds. In the event the Fixed Price Contract Amount is adjusted by Change Order executed by the Contractor, the penal sum of both the performance bond and the payment bond shall be deemed increased by like amount. The performance and payment bonds furnished by the Contractor shall be AIA Document A312, or a standard Surety form certified approved to be the same as the AIA Document A312, and shall be executed by a Surety, or Sureties, reasonably acceptable to the Owner and authorized to do business in the State of Idaho.
- 24.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.
- 24.3** It is the Contractor's obligation to notify the Surety in the event of changes in the Contract Documents, which in the absence of notification might serve to discharge the Surety's obligations, duties or liability under bonds or the Contract.

ARTICLE 25
PROJECT RECORDS

- 25.1** All documents relating in any manner whatsoever to the Project, or any designated portion thereof, which are in the possession of the Contractor or any Subcontractor of the Contractor, shall be made available to the Owner or the Design Professional for inspection and copying upon written request. Furthermore, said documents shall be made available, upon request by the Owner, to any

state, federal or other regulatory authority and any such authority may review, inspect, and copy such records. Said records include all drawings, plans, specifications, submittals, correspondence, minutes, memoranda, tape recordings, videos or other writings or things which document the Project, its design, and its construction. Said records expressly include those documents reflecting the cost of construction to the Contractor. The Contractor shall maintain and protect these documents for no less than four (4) years after final completion or termination of the Contract or for any longer period of time as may be required by law or good construction practice.

ARTICLE 26

MISCELLANEOUS PROVISIONS

- 26.1** The law is hereby agreed to be the law of the State of Idaho. The parties further agree that venue for any proceeding related to this Contract shall be in Boise, Ada County, Idaho, unless otherwise mutually agreed by the parties.
- 26.2** Pursuant to Section 54-1904A, Idaho Code, within thirty (30) days after award of this Contract, the Contractor shall file with the Idaho State Tax Commission, with a copy to the Owner, a signed statement showing the date of Contract award, the names and addresses of the home offices of contracting parties, including all Subcontractors, the state of incorporation, the Project Number and a general description of the type and location of the Work, the amount of the prime contracts and all subcontracts and all other relevant information which may be required on forms which may be prescribed by the Idaho State Tax Commission.
- 26.3** The Contractor, in consideration of securing the business of erecting or constructing Public Works in the State of Idaho, recognizing that the business in which it is engaged is of a transitory character, and that in the pursuit thereof, its property used therein may be without the state when taxes, excises or license fees to which it is liable become payable, agrees:
- (a) To pay promptly when due all taxes (other than on real property), excises and license fees due to the State of Idaho, its sub-divisions, and municipal and quasi-municipal corporations therein, accrued or accruing during the term of this Contract, whether or not the same shall be payable at the end of such term;
 - (b) That if the said taxes, excises, and license fees are not payable at the end of said term, but liability for the payment thereof exists even though the same constitute liens upon its property, to secure the same to the satisfaction of the respective officers charged with the collection thereof; and
 - (c) That, in the event of its default in the payment or securing of such taxes, excises and license fees, to consent that the department, officer, board or taxing unit entering this Contract may withhold from any payment due it hereunder the estimated amount of such accrued and accruing taxes, excises and license fees for the benefit of all taxing units to which said Contractor is liable.
- 26.4** Before entering a Contract, the Contractor shall be authorized to do business in the State of Idaho and shall submit a properly executed Contractor's Affidavit Concerning Taxes (Exhibit D).
- 26.5** Pursuant to Section 44-1002, Idaho Code, it is provided that each Contractor "must employ ninety-five percent (95%) bona fide Idaho residents as employees on any job under any such contract

except where under such contracts fifty (50) or less persons are employed the contractor may employ ten percent (10%) nonresidents, provided, however, in all cases employers must give preference to the employment of bona fide residents in the performance of said Work, and no contract shall be let to any person, firm, association, or corporation refusing to execute an agreement with the above mentioned provisions in it; provided, that, in contracts involving the expenditure of federal aid funds this act shall not be enforced in such a manner as to conflict with or be contrary to the federal statutes prescribing a labor preference to honorably discharged soldiers, sailors, and marines, prohibiting as unlawful any other preference or discrimination among citizens of the United States." (Ref. Section 44-1001, Idaho Code)

- 26.6** The Contractor shall maintain, in compliance with Title 72, Chapter 17, Idaho Code, a drug-free workplace program throughout the duration of this Contract and shall only subcontract work to subcontractors who have programs that comply with Title 72, Chapter 17, Idaho Code.
- 26.7** As between the Owner and Contractor as to acts or failures to act, any applicable statute of limitations shall commence to run, and any legal cause of action shall be deemed to have accrued in any and all events in accordance with Idaho law.
- 26.8** The Contractor and its subcontractors and sub-subcontractors shall comply with all applicable Idaho statutes with specific reference to Idaho Public Works Contractors' licensing laws in the State of Idaho, Title 54, Chapter 19, Idaho Code, as amended.
- 26.9** The Contractor shall not knowingly hire or engage any illegal aliens or persons not authorized to work in the United States and take steps to verify that it does not hire or engage any illegal aliens or persons not authorized to work in the United States. Any misrepresentation in this regard or any employment of persons not authorized to work in the United States constitutes a material breach and shall be cause for the imposition of monetary penalties not to exceed five percent (5%) of the Fixed Price Contract Amount per violation and/or Termination of this Contract. The Contractor also acknowledges that, if it is a natural person, it is subject to Title 67, Chapter 79, Idaho Code regarding verification of lawful presence in the United States.

ARTICLE 27

EQUAL OPPORTUNITY

The Contractor shall maintain policies of employment as follows:

- 27.1** The Contractor and the Contractor's subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, age or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, color, sex, age or national origin. Such action shall include the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
- 27.2** The Contractor and the Contractor's subcontractors shall, in all solicitation or advertisements for employees placed by them or on their behalf; state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, age or national origin.

ARTICLE 28
SUCCESSORS AND ASSIGNS

- 28.1** Each party binds itself, its successors, assigns, executors, administrators or other representatives to the other party hereto and to successors, assigns, executors, administrators or other representatives of such other party in connection with all terms and conditions of this Contract. The Contractor shall not assign this Contract or any part of it or right or obligation pursuant to it without prior written consent of the Owner. If Contractor attempts to make assignment without consent of Owner, Contractor shall remain legally responsible for all obligations under this Contract.

ARTICLE 29
SEVERABILITY

- 29.1** In the event any provision or section of this Contract conflicts with applicable law or is otherwise held to be unenforceable, the remaining provisions shall nevertheless be enforceable and shall be carried into effect.

ARTICLE 30
MEDIATION

- 30.1** Contractor Objections for additional cost or time are subject to Article 14, shall be reviewed as provided in accordance with that Article and, as a condition precedent to litigation, are subject to dispute resolution attempts and mediation in accordance with this Article. All other issues and disputes arising from this contract are also subject to dispute resolution attempts & mediation in accordance with this Article, as a condition precedent to litigation.
- 30.2** The Parties agree that resolution of any dispute or disagreement without formal legal proceedings is to their mutual benefit and to the benefit of the Project.
- 30.3** The parties agree to make every reasonable attempt to resolve any issues or disputes informally. The parties further agree that prior to the institution by either of legal or equitable proceedings of any kind, and as a condition precedent thereto, any dispute between the Contractor and the Owner related to the Contract, including a dispute over the Owner's decision regarding a Claim, shall be subject to mediation as follows:
- (a) If the issue to be mediated involves only a dispute regarding the Contract Time, no request to mediate shall be made unless liquidated damages have been assessed by the Owner. If the issue to be mediated involves a Claim or other financial dispute, no request to mediate shall be made unless the amount is \$50,000 or more or until there are cumulative Claims or disputes amounting to \$50,000 or more; provided, however, that a mediation request can be made as to any Claim or financial matter at any time after Substantial Completion;
 - (b) The party seeking mediation shall notify the other party in writing of its mediation request. In such written request, the requesting party must clearly describe the issues it believes are subject to mediation;
 - (c) Within fifteen (15) days of receipt of the mediation request, the non-requesting party shall respond in writing to the request;

- (d) Unless the Owner and the Contractor agree to other rules for mediation, mediation shall be in accordance with the Construction Industry Rules of Arbitration and Mediation Procedures in effect at the time of the mediation;
- (e) The parties shall share the mediator's fee and any filing fees equally; provided, however, that if a party makes a written request to the mediator without satisfying the requirements of this section and by doing so incurs any costs or fees, that party shall be solely responsible for the costs or fees;
- (f) Unless otherwise mutually agreed to by the parties, the mediation shall be in Boise, Ada County, Idaho;
- (g) The parties shall cooperate in arranging the other details of mediation, such as selection of the mediator, mediation dates and times;
- (h) The parties agree that all parties necessary to resolve the matter shall be parties to the same mediation proceeding; provided, however, that no Subcontractor or sub-subcontractor shall attend the mediation absent advance notice and consent from the Owner;
- (i) Agreements reached in mediation shall be enforceable as settlement agreements in any court having proper jurisdiction; and
- (j) Unless otherwise agreed in writing, the Contractor shall continue the work and maintain the approved schedules during any mediation proceedings. If the Contractor continues to perform, the Owner shall continue to make payments in accordance with the Contract Documents.

30.4 If mediation fails to resolve the dispute, either party may file an action in the courts of Idaho in accordance with the venue provision contained in this Contract.

ARTICLE 31

WAIVER OF CONSEQUENTIAL DAMAGES

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

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

31.2 This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Articles 18 and 20. Nothing contained in this paragraph shall be deemed to preclude an award of the assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

IN WITNESS WHEREOF, the parties have executed this Contract on the dates set forth below.

OWNER:

State of Idaho
Division of Public Works

Authorized Signature

Date

Kelly Berard

Print Signature

Administrator

Title

CONTRACTOR:

Contractor's Name- Typed

Authorized Signature

Date

Print Signature

Title

EXHIBIT A

PROJECT IDENTIFICATION, ADDENDA, CONTRACT AMOUNT, CONTRACT TIME, ACCEPTED ALTERNATIVES, LIQUIDATED DAMAGES, AND SPECIAL CONDITIONS (IF ANY)

OWNER'S PROJECT IDENTIFICATION INFORMATION:

DPW Project No.: 26-233

Project Title: ISU Eames Building 96 Remodel

Project Location: Idaho State University, Pocatello, ID

General Project Description: The Remodel of approximately 24,000 sq ft of existing unused research space into new classrooms, studio spaces, and offices.

ADDENDA: Addenda applicable to the Contract and made a part of are as follows:

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

FIXED PRICE CONTRACT AMOUNT AND ACCEPTED ALTERNATES:

Base Bid Amount:				\$.00
Alternate No. _____	(_____)	add		\$.00
Alternate No. _____	(_____)	add		\$.00
Alternate No. _____	(_____)	add		\$.00

Total Fixed Price Contract Amount
(_____) Dollars \$.00

Contractor's Requests for Payment are to be submitted for Work accomplished through the _____ day of each month as described in Paragraph 7.3.

TIME FOR PERFORMANCE AND LIQUIDATED DAMAGES:

A. The Contractor shall commence construction of its scope of the Work in accordance with the Notice to Proceed issued by the Owner, and which will become Exhibit F to this Contract.

B. The Contractor shall accomplish Substantial Completion as defined in Article 6 of the Contract within Two hundred and Seventy-four (274) consecutive calendar days from the date authorized to proceed in the Notice to Proceed.

C. The amount of liquidated damages per day for each and every day of unexcused delay as outlined in Article 6 on the Contract is: Five Hundred Dollars (\$ 500.00)

DRAWINGS AND SPECIFICATIONS:

The Owner shall furnish the Contractor 3 sets of Drawings and Project Manuals.

EXHIBIT B

ADDRESSES AND AUTHORIZED REPRESENTATIVES (INCLUDING LIMITATIONS)

The names, addresses and authorized representatives of the Owner, the Contractor and the Design Professional are:

OWNER: State of Idaho
Division of Public Works 502
N. 4th Street
P.O. Box 83720
Boise, ID 83720-0072
Kelly Berard, Administrator

Project Manager: Name: John Parham
Telephone: (208) 332-1909
E-mail: john.parham@adm.idaho.gov
May sign for Owner: Yes [X] No []

Field Representative: Name: Fred Richards
Telephone: (208) 269-0639
E-mail: fred.richards@adm.idaho.gov
May sign for Owner: Yes [☒] No [☐]

CONTRACTOR: _____ (company name)
 _____ (address or PO address)
 _____ (city, state, zip)
 _____ (telephone)
 _____ (email)
 Public Works Contractors License No. _____

Contractor's
Project Manager: _____ (name)
 _____ (telephone)
 _____ (E-mail)
 May sign for Contractor: Yes [☐] No [☐]
 Change Orders: up to: \$_____.00
 Construction Change Authorizations: up to: \$_____.00
 Contractor's Request for Payment

Contractor's
Superintendent: _____ (name)
 _____ (telephone)
 _____ (E-mail)

May sign for Contractor: Yes [☐] No [☐]

Construction Change Authorizations: up to \$_____.00

**DESIGN
PROFESSIONAL:**

JHS Architects, P.A. (firm name)
125 N. Garfield Ave. (address or PO address)
Pocatello, ID 83204 (city, state and zip)
(208) 232-1223 (telephone)
____ (FAX)

Professional's
Project Manager:

Scott Lloyd (name)
Professional License No. AR-986832
(208) 232-1223 (telephone)
____ (FAX)
scott@jhsarchitects.com (E-mail)

Professional's
Field Representative:

____ (name)
____ (telephone)
____ (E-mail)

May sign for Design Professional:

Field Reports	Yes [X]	No []
Change Order Proposal Requests	Yes [X]	No []
Construction Change Authorization:	Yes [X]	No []
Construction Change Order	Yes [X]	No []
Design Professional's Supplemental Instructions	Yes [X]	No []
Interpretations of the Contract Documents	Yes [X]	No []
Contractor's Request for Payment	Yes [X]	No []
Acceptance of Substantial Completion	Yes [X]	No []
Acceptance of final completion	Yes [X]	No []

EXHIBIT C

REFERENCE TABLE

ADVERTISEMENT FOR BIDS	AB-1
INSTRUCTIONS TO BIDDERS	ITB-1
BID PROPOSAL	BP-1
CONTRACTOR'S AFFIDAVIT CONCERNING ALCOHOL & DRUG-FREE WORKPLACE	BP-4
BIDDER'S ACKNOWLEDGEMENT STATEMENT	BP-5
AGREEMENT – FIXED PRICE CONSTRUCTION CONTRACT	FPCC-1
EXHIBIT A – OWNER'S PROJECT IDENTIFICATION INFORMATION	FPCC-34
EXHIBIT B – ADDRESSES AND AUTHORIZED REPRESENTATIVES	FPCC-35
EXHIBIT C – LIST OF DRAWINGS AND SPECIFICATIONS	FPCC-37
EXHIBIT D - CONTRACTOR'S AFFIDAVIT CONCERNING TAXES	FPCC-39
EXHIBIT E – NAMED SUBCONTRACTORS	FPCC-40
EXHIBIT F – NOTICE TO PROCEED	FPCC-41
EXHIBIT G - CONTRACTOR'S REQUEST FOR TAX RELEASE	FPCC-43
EXHIBIT H - RELEASE OF CLAIMS	FPCC-44
EXHIBIT J – CONDITIONS PRECEDENT TO FINAL PAYMENT	FPCC-45
EXHIBIT K – TRAINING CONFIRMATION SIGN IN SHEET	FPCC-46
EXHIBIT L – PROJECT FINALIZATION AND STRART UP	FPCC-47

TECHNICAL SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

01 1000	SUMMARY	1-3
01 2300	ALTERNATES	1
01 2500	SUBSTITUTION PROCEDURES	1-2
01 2600	CONTRACT MODIFICATION PROCEDURES	1-2
01 2900	PAYMENT PROCEDURES	1-2
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CONTRACTOR'S AFFIDAVIT CONCERNING TAXES

EXHIBIT E

NAMED SUBCONTRACTORS

Pursuant to Section 67-2310, Idaho Code, commonly known as the naming law, the names and addresses of the entities who will perform the plumbing, heating and air conditioning and electrical work were named in the bid and are as follows:

Plumbing (PWCL Category 15400)

(Name) _____

(Address) _____

Idaho Public Works Contractors License No. _____

Idaho Plumbing Contractors License No. _____

Heating Ventilating & Air Conditioning (PWCL Category 15700-HVAC)

(Name) _____

(Address) _____

Idaho Public Works Contractors License No. _____

Idaho HVAC Contractors License No. _____

Electrical (PWCL Category 16000)

(Name) _____

(Address) _____

Idaho Public Works Contractors License No. _____

Idaho Electrical Contractors License No. _____

EXHIBIT F

NOTICE TO PROCEED

TO CONTRACTOR: _____ DPW NUMBER: _____

CONTRACT DATE: _____ ARCHITECT: _____

CONTRACT AMOUNT: \$ _____

DATE OF ISSUANCE: _____ OWNER: State of Idaho

You are hereby notified to commence work on the above referenced contract on/or before _____, _____ and are to substantially complete the work within _____ consecutive calendar days thereafter; therefore your contract completion date is _____.

The contract provides for the sum of \$ _____ as liquidated damages for each consecutive calendar day after the above established substantial completion date that the Work remains incomplete. Completion date will be established by "Certificate of Substantial Completion."

You are reminded that any changes to the original contract document regarding either cost or completion date must be affected by a change order approved by this department.

Your payment estimates must be submitted on Division of Public Works forms included herein. We will be most happy to assist you in preparing the payment estimate forms.

Fred Richards has been appointed Field Representative for this project. Please contact him at **(208) 269-0639** prior to beginning Work. A pre-construction meeting will be held on _____, _____, at _____, _____ at _____.(location)

Sincerely,

Kelly Berard
Administrator

DR: **

DISTRIBUTION: Tax Commission
Division of Occupational and Professional Licenses
Risk Management (w/ Builder's Risk Application, if applicable)
(Project Manager)
Fiscal Office TAX ID xx-xxxxxxx

EXHIBIT G
Idaho State Tax Commission
REQUEST FOR TAX RELEASE

Date: _____

PART I -- AWARDING AGENCY INFORMATION:

Name of agency	Mailing address	City, state, and ZIP Code
Contact name	Phone number	Email address

PART II -- CONTRACTOR INFORMATION:

Name of contractor	Mailing address	City, state, and ZIP Code
Federal EIN	Contact name	Phone number
		Email address

PART III -- CONSTRUCTION/CONTRACT MANAGER INFORMATION (if applicable):

Name of business	Mailing address	City, state, and ZIP Code
Federal EIN	Contact name	Phone number
		Email address

Send a copy of the approved Tax Release to: Awarding Agency ☐ Contractor ☐ Construction ☐ Manager ☐

NOTE: We will email all copies unless otherwise requested

PART IV -- PROJECT INFORMATION:

Name of project	Location of project

Description of project

Project number assigned by awarding agency	Project start date	Project completion date	Final/closing contract amount (includes all change orders)
			\$

Did any government entities supply materials which were installed by this contractor or its subs?:
_____ Yes _____ No

If YES, list these materials and their dollar values. (Attach additional information if needed):

List Materials	List Dollar Values of Materials
	\$
	\$
	\$

Send to: Contract Desk/Sales Tax Audit
 Idaho State Tax Commission
 PO Box 36
 Boise ID 83722-0410
 Phone: (208) 334-7618 • Fax: (208) 332-6619 • Email: contractdesk@tax.idaho.gov

NOTE: Please allow 30 days to process a Tax Release Request. You must send a complete, signed Form WH-5 Public Works Contract Report to the Idaho State Tax Commission to complete this request.

EXHIBIT H

RELEASE OF CLAIMS

(TO BE COMPLETED FOR FINAL PAYMENT)

I, _____, do hereby release the State of Idaho from any and all claims of any character whatsoever arising under and by virtue of DPW contract number _____, dated _____, as amended, except as herein stated.

Dated: _____

Contractor: _____

EXHIBIT J

CONDITIONS PRECEDENT TO FINAL PAYMENT

Date: _____
DPW Project No. _____
Project Title: _____
Location: _____

Send to:
State of Idaho
Division of Public Works
502 N. Fourth Street
Boise, Idaho 83702

Copy to:
Design Professional

Contractor's Responsibilities:

Per Paragraph 7.14 of the Fixed Price Contract: As a condition precedent to final payment, the Contractor must furnish the owner, in the form and manner required by Owner, to be submitted to the Design Professional for approval, the following:

- ☐ Contractor's Final Request for Payment Form has been uploaded to OMS.
- ☐ Release of Claims form has been uploaded to OMS (DPW's form, Exhibit H)
- ☐ Contractor's Affidavit of Payment of Debts and Claims Form has been uploaded to OMS (AIA G706)
- ☐ Consent of Surety to Final Payment has been uploaded to OMS (AIA G707)
- ☐ Confirmation of all required training (DPW's Training Confirmation Exhibit K), product warranties, operating manuals, instruction manuals and other record documents, drawings and items customarily required of the Contractor has been uploaded to OMS.
- ☐ Public Works Contract Tax Release from the Idaho Tax Commission has been uploaded to OMS.
- ☐ Division of Occupational and Professional Licenses Letter of Completion/Final Inspection has been uploaded to OMS (as required).
- ☐ Project Finalization and Start Up has been uploaded to OMS (as required, Exhibit L).

Contractor's Signature

Date

Design Professional's Approval for Payment:

- ☐ All Documents Required per Paragraph 7.14 of the Fixed Price Contract have been uploaded to OMS.
- ☐ All Warranties, Guarantees, etc. have been received, approved and have been uploaded to OMS.
- ☐ Contractor's As-Built Drawings, have been received, reviewed, approved, and uploaded to OMS in PDF format.
- ☐ Final punch list with AE's verification that all items have been completed, has been uploaded to OMS.
- ☐ Record Drawings have been completed by AE. All required copies of the Record Documents and electronic media are attached and uploaded to OMS in PDF, and DWG 2010 format. DWG files should be bound in zip folder, or "e-transmit" folder, containing all drawing files with relevant dependencies (i.e. x-refs, images, title blocks, and pen settings). *Record Drawings are a requirement for the AE's final payment, not the Contractor's.*

To the best of my knowledge, information, and belief, and on the basis of my observations and inspections, I certify the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the required documentation required by Paragraph 7.14 of the fixed priced contract has been received. The entire balance, as shown on the attached Final Request for Payment, is due and payable.

Design Professional's Signature

Date

FIXED PRICE CONSTRUCTION CONTRACT

FPCC - 54

DPW Project # 26-233
May 2026

EXHIBIT K

**STATE OF IDAHO
DIVISION OF PUBLIC WORKS**

TRAINING CONFIRMATION SIGN-IN SHEET

DPW Project: _____

Agency: _____

Project Name: _____

Project Location: _____

Field Representative: _____

Date & Time: _____

Name	Company	E-mail	Telephone	Signature

V:\Design and Construction\CONTRACT ADMINISTRATION\Close Out\Training Confirmation Sign In Sheet.xlsx

EXHIBIT L

PROJECT FINALIZATION AND START-UP

Upon completion of the equipment and systems installation and connections, the contractor shall assemble all equipment factory representative and subcontractors together for system start-up.

These people shall assist in start-up and check out their system(s) and remain at the site until the total system operation is acceptable and understood by the agency's representative(s). The factory representative and system subcontractor shall also give instructions on operation and maintenance of their equipment to the agency's maintenance and/or operation personnel. To prove acceptance of operation and instruction by the agency's representative(s), this written statement of acceptance shall be signed below.

"I, the Contractor, associated factory representative and subcontractors, have started each system and the total system; and have proven their normal operation to the agency's representative(s) and maintenance/operation personnel and have instructed him/them in the operation and maintenance thereof."

Agency's Representative

Contractor

Signature

Signature

Date

Date

SECTION 011000**SUMMARY****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Service Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work by Owner
 - 4. Access to site.
 - 5. Coordination with occupants.
 - 6. Work restrictions.
 - 7. Specification and drawing conventions.
 - 8. Miscellaneous provisions.
 - 9. General Security Requirements
 - 10. Permits
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: DPW # 26-233
 - 1. Project Location: Idaho State University
 - a. Eames Building #96
 - Pocatello, ID 83209
- B. Owner: State of Idaho
 - 1. Owner's Project Manager (DPW): John Parham (208) 332-1909
 - 2. Owner's Field Representative (DPW): Fred Richards (208) 269-0639
- C. Agency: Idaho State University
 - 1. Agency's Representative: Cole Elquist (208) 282-2472
- D. Architect or Engineer (Design Professional): JHS Architects, P.A.
 - 1. Scott Lloyd (208) 232-1223

1.4 WORK COVERED BY CONTRACT DOCUMENTS

The Work of Project is defined by the Contract Documents and consists of the following:
Remodel of the former lab space into new classroom and studio spaces.

- A. Type of Contract:
 - 1. Project will be constructed under a single prime contract per the Division of Public Works Fixed Price Construction Contract between Owner and Contractor. (Boilerplate, June 2025)

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Items noted NIC (Not in Contract), will be furnished and installed by the Owner/Agency.

1.6 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.6 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to access points and work vehicles parking reviewed during Prebid Conference.
 - 2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - c. Contractor parking shall be limited to those areas reviewed and approved during Prebid Conference.
 - d. Maintain clear access to project at all times for firefighting equipment. Maintain exit ways from existing building required by authorities having jurisdiction.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Any damage to the building, due to negligence on behalf of the contractor to not maintain a weather-tight condition, shall be the responsibility of contractors and they shall bear the burden for correction and/or repairs for any damage. Repair damage caused by construction operations.
- D. Security: The contractor shall maintain security of the building's construction areas and any staging areas throughout the project.
- E. Behavior and Dress: Inappropriate behavior by construction personnel and workers will not be tolerated. This includes inappropriate clothing, inappropriate language and inappropriate comments directed at DHW Staff or other public.

1.7 PROTECTION OF BUILDING, CONTENTS, AND GROUNDS.

- A. Construction Site Lay-down and Storage: Coordinate lay-down and storage areas with owner prior to construction.
- B. Verify with Agency any specific requirements.

1.8 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy other areas of the existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing building exits without fail.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 48 hours in advance of activities that will affect Owner's operations.
 - 3. The Owner will take special care not to damage materials or work completed by the contractor prior to final acceptance. If the contractor occurs any damages, prior to final acceptance, notify the Owner and Architect immediately for verification of damages. If the contractor fails to notify the Owner and Architect within 24 hours of the incident, the contractor shall be responsible for the performance and shall bear the cost of correction.

1.9 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Use of non-construction areas of site and premises by the public.
 - 3. Coordinate hours of work with ISU Project Manager.

- C. Provide access to and from site as required by law and by Owner:
- D. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
- E. Parking: Parking is limited and allowed in areas identified at Pre-Construction Conference. No parking shall be permitted within ADA parking areas. No parking will be permitted on sidewalks or similar concrete areas. Parking within staging areas may be permitted by special agreement with the Agency Field Representative.
- F. Smoking Policy: Smoking is prohibited on all property wholly owned, leased or operated by the State of Idaho. This consists of all buildings, all grounds, including exterior open spaces, parking lots, on-campus sidewalks.
Smoking is hereby defined as the burning of tobacco or any other material in any type of smoking equipment, including but not restricted to cigarettes, "E" cigarettes, cigars or pipes.
- G. Noise, Vibration, and Odors: Written notice shall be given to Agency two weeks in advance of scheduled work activities that may result in high levels of noise, vibrations, odors, or any other activities that may be disruptive to Owner Occupancy.
- H. On-Site Work Hours: Work activities to be performed Monday through Friday 7 a.m. to 6 p.m. Work activities may include off-hours and weekends, coordinated with Agency Field Representative.

1.10 PERMITS

- A. Furnish all necessary permits for construction of the Work.

1.11 WASTE DISPOSAL

- A. The contractor is responsible for any and all demolition and/or removal as necessary and required to fulfill the requirements of the Contract Documents.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.
 - 3. Keynoting: Materials and products are identified by reference keynotes.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)**

END OF SECTION

SECTION 012300**ALTERNATES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Add Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost for each alternate is the net addition to the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION****3.1 SCHEDULE OF ALTERNATES**

- A. Additive Alternate No. ONE: FLOOR, CEILING FINISHES AND CORRIDOR 174
 - 1. Base Bid Condition: Provide no floor finishes, ceiling finishes.
 - 2. Add Alternate: Provide floor finishes and ceiling finishes within (E) Corridor 174 per Finish Schedule (A3.1).
- B. Additive Alternate No. TWO: CLASSROOM WINDOWS
 - 1. Base Bid Condition: Provide no windows within Classrooms 48, 49, 50A, 50B, 71, and 72.
 - 2. Add Alternate: Provide windows (Window Type C) within Classrooms 48, 49, 50A, 50B, 71, and 72.
- C. Additive Alternate No. THREE: PROCUREMENT AND INSTALLATION OF RTU-24
 - 1. Base Bid Condition: Procurement and installation of RTU-24 not included in base bid
 - 2. Add Alternate: Provide the procurement and installation of RTU-24 per mechanical sheets.

END OF SECTION

SECTION 012500**SUBSTITUTION PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

- k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
- 1.4 QUALITY ASSURANCE**
 - A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.
- 1.5 PROCEDURES**
 - A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.
- 1.6 SUBSTITUTIONS**
 - A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
 - B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION**

SECTION 012600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, through Owner's web-based management software (OMS). ASI may be completed on AIA Document G710, "Architect's Supplemental Instructions" and attached into OMS.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, the Architect will complete the Owner's Change Order Form and attach the Proposal Request and back-up. The Architect will then forward this documentation to the Owner's Project Manager who will create a Change Order through OMS for approval of the Owner and Contractor. Note approval is determined after Change Order is approved through OMS.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION**

SECTION 012900**PAYMENT PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment on **DPW's Owners web-based management software (OMS)**.

1.2 SCHEDULE OF VALUES (SOV)

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Submit the schedule of values on Owner's or other approved "schedule of values" form to Division of Public Works seven days after contract is approved.
 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts where needed.
 3. Provide a separate line item in the SOV for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 4. Allowances: Provide a separate line item in the SOV for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
 6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling 1% percent of the Contract Sum and subcontract amount.
 8. Review and approval by the Architect and Owner (DPW's Project Manager and DPW's Field Representative) is required prior to the first payment application.

1.3 PAYMENT APPLICATIONS

- A. Each Pay Application or Invoice, including SOV as attachment shall be submitted via the **OMS** under the 'Cost Tracking/Contract Mgmt.' module where they will be **electronically approved** by the Contractor, Architect, DPW Field Representative, DPW Project Manager, and DPW Senior Field Representative. The Schedule of Value must be included and attached in OMS with the Invoice.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Payment Application is the period indicated in the Agreement.
- C. Payment Application Times: Create Pay Applications on the Owners web-based management software by the 21st of the month and electronically submit for approval. The period covered by each Payment Application is one month, ending on the **last day of the month**.

- D. Initial Payment Application: Administrative actions and submittals that must precede or coincide with submittal of first Payment Application include the following:
1. List of subcontractors.
 2. Contractor's construction schedule (preliminary if not final).
 3. Products list (preliminary if not final).
 4. Schedule of unit prices.
 5. Submittal schedule (preliminary if not final).
 6. Copies of building permits.
 7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 8. Initial progress report.
 9. Data needed to acquire Owner's insurance or Builders Risk from the Contractor.
- E. Payment Application at Substantial Completion: After Architect issues the Certificate of Substantial Completion, upload a Payment Application showing 100 percent completion for portion of the Work claimed as substantially complete. Retainage will continue to be held until approval of Final Payment Application.
- F. Final Payment Application: After completing Project closeout requirements, submit final Payment Application with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Marked up Record Drawings and Specifications.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Contractor's Affidavit of Payment of Debts and Claims Form. AIA Document G706.
 5. Consent of Surety to Final Payment. AIA Document G707.
 6. Release of Claims form, Exhibit H. Evidence that claims have been settled.
 7. Confirmation of all required training, product warranties, operating manuals, instruction manuals and other record documents, drawings and items customarily required of the Contractor.
 8. Public Works Contract Tax Release from the Idaho Tax Commission.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Any and all other items required by DPW under the applicable contract requirements.
 12. Authority Having Jurisdiction/Division of Professional Licensing (AHJ/DOPL) inspection approval and occupancy permit issued.

END OF SECTION

SECTION 013100**PROJECT MANAGEMENT AND COORDINATION****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Project meetings.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Design Professional, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Key Personnel Names: Within seven (7) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Processing of submittals.
 - 5. Progress meetings.

6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of Design Professional, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Design Professional indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show Design Professional and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:

- a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Design Professional will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Design Professional determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Design Professional will so inform Contractor, who shall make changes as directed and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
 11. Review: Design Professional will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.
 - C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Preparation Format: **PDF**.
 3. File Submittal Format: Submit or post coordination drawing files **PDF format**.
 4. Design Professional will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Design Professional makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in PDF.
 - c. Contractor shall execute a data licensing agreement in the form of **Agreement form acceptable to Owner and Design Professional**.
- 1.7 REQUEST FOR INFORMATION (RFI)**
- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and upload an RFI in the Owners web-based management software (OMS).
 1. Design Professional will approve RFIs with any comments through OMS.
 2. Design Professional shall notify DPW of the Design Professional's Representative who will receive and respond to RFIs.
 3. Contractor to upload RFIs in a prompt manner so as to avoid delays in the work or work of subcontractors.
 4. Contractor and Design Professional can copy any Team members the question and/or response within OMS.
 - B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Input information required by OMS.
 2. Specification Section number and title and related paragraphs, as appropriate.
 3. Drawing number and detail references, as appropriate.
 4. Field dimensions and conditions, as appropriate.
 5. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 6. Attachments: Upload sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - C. Design Professional's Action: Design Professional will review each RFI, determine action required, and respond. Allow seven (7) working days for Design Professional's response for

each RFI. RFIs received by Design Professional after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Design Professional's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Design Professional's action may include a request for additional information, in which case Design Professional's time for response will date from time of receipt by Design Professional of additional information.
3. Design Professional's action on RFIs that may result in a change to the Contract Time or the Contract Sum in which case the Contractor may submit a Proposed Request to the Design Professional.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Design Professional in writing within seven (7) days of receipt of the RFI response.
- D. On receipt of Design Professional's action, review response and notify Design Professional within seven (7) days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Design Professional's Data Files: Design Professional **will** provide Design Professional's PDF digital data files for Contractor's use during construction.
- B. Use of Design Professional's Digital Data Files: Digital data files of Design Professional's PDF drawings will be provided by Design Professional for Contractor's use during construction.
 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 2. Design Professional makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Contract Drawings are available in PDF format.
 4. Contractor shall execute a data licensing agreement in the form of **AIA Document C106 Digital Data Licensing Agreement**.
 - a. Subcontractors, and other parties granted access by Contractor to Design Professional's digital data files shall execute a data licensing agreement in the form of **AIA Document C106**.
 5. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
- C. Web-Based Project Software: Use **Owner's** web-based management software site (OMS) for purposes of hosting and managing Project communication and documentation until Final Completion.
 1. Web-based Project software site includes the following features for:
 - a. Compilation of Project data, including Contractor, subcontractors, Design Professional, Design Professional's consultants, Owner, and other entities involved in Project.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents. The 'My Team' module Includes names of individuals and contact information.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Proposed Change Orders, Construction Change Directives, and Change Orders.

- e. Tracking status of each Project communication in real time, and log time and date when responses are provided.
 - f. Handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.
 - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of daily field reports.
 - l. Mobile device compatibility, including smartphones and tablets.
- D. PDF Document Preparation: Where PDFs are required to be submitted to Design Professional, prepare as follows:
- 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: The Design Professional will schedule and conduct monthly meetings at the Project site unless otherwise indicated.
- B. Preconstruction Conference: The Owner will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Design Professional.
- 1. Attendees: Authorized representatives of Owner, Contractor and its superintendent, and major subcontractors shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Owner's standard preconstruction agenda will be used.
 - 3. Minutes: The Design Professional will be responsible for the monthly meeting minutes and will record and distribute via the OMS
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Design Professional, Owner, of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.

- q. Acceptability of substrates.
- r. Temporary facilities and controls.
- s. Space and access limitations.
- t. Regulations of authorities having jurisdiction.
- u. Testing and inspecting requirements.
- v. Installation procedures.
- w. Coordination with other work.
- x. Required performance results.
- y. Protection of adjacent work.
- z. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
- 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Construction Progress Meetings: The Contractor will conduct progress meetings at monthly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Agency and Design Professional, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site use.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) As-Built Updates.
 - 20) Pending claims and disputes.

- 21) Documentation of information for payment requests.
4. Minutes: Contractor is responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Contractor shall revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

END OF SECTION

SECTION 013300**SUBMITTAL PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

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

1.3 SUBMITTAL SCHEDULE

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

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Design Professional.
 - 4. Name of Construction Manager.
 - 5. Name of Contractor.
 - 6. Name of firm or entity that prepared submittal.
 - 7. Names of subcontractor, manufacturer, and supplier.
 - 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 - 9. Category and type of submittal.
 - 10. Submittal purpose and description.
 - 11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 - 12. Drawing number and detail references, as appropriate.
 - 13. Indication of full or partial submittal.
 - 14. Location(s) where product is to be installed, as appropriate.
 - 15. Other necessary identification.
 - 16. Remarks.
 - 17. Signature of transmitter.
- B. Options: Identify options requiring selection by Design Professional.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Design Professional on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Submittals:

1. Upload Submittals on Owners web-based management software (OMS). Contractor to initiate the process via "Construction Management", then "Submittal" tab within the website.
- E. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Web-Based Project Software: Prepare submittals in PDF form, and upload to OMS. Enter required data in web-based software site to fully identify submittal.
 2. Samples: Prepare submittals and deliver to Design Professional.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Design Professional's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow seven (7) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Design Professional will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow seven (7) days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form as initial submittal.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Design Professional's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - 3. Transmittal: Upload PDF transmittal to the Owners web based management software under submittals. Include digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Web-Based Project Software: Prepare submittals in PDF form, and upload to Owners web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 - 5. Paper Transmittal: Include paper transmittal including complete submittal information indicated for samples delivered to the Design Professional.
 - 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Design Professional will return submittal with options selected.
 - 8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three (3) sets of Samples. Design Professional will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

- 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least two sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Design Professionals and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Design Professional.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, upload to the Owners web-based management software, shall be signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before uploading to the Owners web based management software.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp that is indicated on the web-based submittal. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Design Professional will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 DESIGN PROFESSIONAL'S REVIEW

- A. Action Submittals: Design Professional will review each submittal, indicate corrections or revisions required within the "Comment" box on the web site.
 1. Submittals by Web-Based Project Software: Design Professional will indicate, on Project software website, the appropriate action.
 - a. Actions taken by indication on Project software website have the following meanings:
 - 1) Approved, No exceptions taken, Pending, Overdue, Complete, or Rejected.
- B. Informational Submittals: Design professional will review each submittal and will not return it if it does not comply with requirements. Design professional will forward each submittal to the appropriate party.
- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be rejected for resubmittal without review.
- D. Submittals returned through OMS without action will show up as Design Professional being non-responsive.
- E. Submittals not required by the Contract Documents will be returned by Design Professional without action.

END OF SECTION

SECTION 014000**QUALITY REQUIREMENTS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by the Design Professional.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Design Professional for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Professional for a decision before proceeding.
- C. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Design Professional has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services. These services, or special inspections, provided to the Owner are for the express purpose of meeting the testing requirements required under the authorities having jurisdiction and shall not in any way be considered to replace the Contractor's responsibility for quality assurance and control for the project.
1. Contractor will coordinate and schedule all testing and special inspections with the Owner's testing agency.
 2. Under no circumstances will the Owner's testing agency perform quality control or quality assurance work for the Contractor.
 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
 4. Initial reports (handwritten as a minimum) will be given to the Contractor by the Owner's testing Agency before leaving the site the day of the inspection.
 5. Final reports will be issued later to the Contractor, Design Professional, and Owner.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Owner, Design Professional, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Owner, Design Professional, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service to Owner, Design Professional, and Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Design Professional, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.7 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner as follows:
- B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Owner and Design Professional's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 016000**PRODUCT REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Design Professional through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Design Professional's Action: If necessary, Design Professional will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Design Professional will notify Contractor of approval or rejection of proposed comparable product request within seven (7) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
 - a. Form of Design Professional's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Design Professional does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS**2.1 PRODUCT SELECTION PROCEDURES**

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Design Professional will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ..."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: ..."
 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ..."
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ..."
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ..."
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ..."
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

- C. Visual Matching Specification: Where Specifications require "match Design Professional's sample," provide a product that complies with requirements and matches Design Professional's sample. Design Professional's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Design Professional from manufacturer's full range" or similar phrase, select a product that complies with requirements. Design Professional will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Design Professional will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 2. Evidence that proposed product provides specified warranty.
 - 3. List of similar installations for completed projects with project names and addresses and names and addresses of Design Professionals and owners, if requested.
 - 4. Samples, if requested.

END OF SECTION

SECTION 017300**EXECUTION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Design Professional of locations and details of cutting and await directions from Design Professional before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Design Professional's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be

relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

- a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
6. Dates: Indicate on the contractor's schedule when cutting and patching will be performed.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Design Professional for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility, Design Professional and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Design Professional according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of in occupied spaces and in unoccupied spaces, or as required by authorities having jurisdiction.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Design Professional.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Remove and replace damaged, defective, or non-conforming Work.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 AGENCY-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's and Agency construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner and Agency construction personnel.
 1. Construction Schedule: Inform Owner/Agency of Contractor's preferred construction schedule for Owner/Agency portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner/Agency in a timely manner if changes to schedule are required due to differences in actual construction progress.
 2. Pre-installation Conferences: Include Owner/Agency construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner/Agency work. Attend pre-installation conferences conducted by Owner/Agency construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.

- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 017700**CLOSEOUT PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.
- B. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- C. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Idaho Division of Public Works Close-Out requirements, including "Conditions Precedent to Final Payment" list. The "Project Finalization" form is required unless specifications indicate otherwise.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of seven (7) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including As-Built documents indicating all revisions to Project Documents, project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals in both hard copy and electronic copy specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Design Professional. Label with manufacturer's name and model number.
 5. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 6. A final report of Special Inspections to be attached to the Substantial Completion. If no Special Inspections are required, Design Professional can initial as such on the Substantial Completion form.
 7. Submit O&M Manuals for compliance with the contract documents in both hard copy and electronic copy.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of seven (7) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Design Professional will either proceed with inspection or notify Contractor of unfulfilled requirements. Design Professional will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Design Professional, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.
- 1.5 FINAL COMPLETION PROCEDURES**
- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit final Application for Payment according to Section 012900 "Payment Procedures" via the OMS.
 2. Certified List of Incomplete Items: Submit certified copy of Design Professional's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Design Professional. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Idaho Division of Public Works Close-Out requirements.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Design Professional will either proceed with inspection or notify Contractor of unfulfilled requirements. Design Professional will approve/initial punch list after inspection or will notify Contractor of construction that must be completed or corrected before final documents will be signed. .

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order
 - 2. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Design Professional will return annotated file.
 - b. PDF electronic file. Design Professional will return annotated file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Design Professional for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within ten (10) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit by uploading to web-based project software site.
- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS**2.1 MATERIALS**

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

PART 3 - EXECUTION**3.1 FINAL CLEANING**

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

- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls," comply with demolition and construction waste disposal requirements of Section 024100 "Demolition."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations, as well as any damage to surrounding areas. Repair includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition before requesting inspection for determination of Substantial Completion.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.

- a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
- 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
- 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
- B. Repair, or remove and replace, defective construction.

END OF SECTION

SECTION 01 7823**OPERATION AND MAINTENANCE DATA****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Design Professional will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
 - 2. Submit three paper copies. Design Professional will return two copies with comments.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 7 (seven) days before commencing demonstration and training. Design Professional will return copy with comments.
 - 1. Correct or revise each manual to comply with Design Professional's comments. Submit copies of each corrected manual within 15 days of receipt of Design Professional's comments and prior to commencing demonstration and training.
- D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Design Professional.
 8. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
 9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.

- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
- B. Content: For each system, subsystem, and pieces of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- H. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.

5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

END OF SECTION

SECTION 017839**PROJECT RECORD DOCUMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 017000 "Closeout Submittals".
 - 2. Section 017300 "Execution" for final property survey.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record As-Built prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit one paper-copy set(s) of marked-up record prints.
 - 2) Upload PDF electronic files of scanned record prints and one of file prints onto DPW's Owners Web-based Management Software.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit one paper-copy set of marked-up record prints.
 - 2) Upload PDF electronic files of scanned record prints onto DPW's Owners Web-based Management Software.
 - 3) Architect will review for completeness.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications on to DPW's Owners Web-based Management Software.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications on to DPW's Owners Web-based Management Software.
- D. Retain subparagraph below if certain record Product Data are required for separate submittal as part of operation and maintenance data in lieu of cross-referencing to the record submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper or electronic copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.

- e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: DWG, compatible with Microsoft Windows and Apple Macintosh operating system.
 3. Format: Annotated PDF electronic file with comment function enabled.
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Architect for resolution.
 6. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize record prints into manageable sets. If required, bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

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

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- C. Format: Submit record Product Data as paper copy and scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS**PART 3 - EXECUTION**

END OF SECTION

SECTION 017900**DEMONSTRATION AND TRAINING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit one copy (1) within seven (7) days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data." Upload PDF files to OMS.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Design Professional.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

- a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.

- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner through Agency Representative with at least ten (10) days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and remove from Project. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video.
 - 1. Submit video recordings on USB thumb drive.
- C. Recording: Display continuous running time.
- D. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 024119 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. REFERENCE STANDARDS
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 017300 "Execution" for cutting and patching procedures.

1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

- A. A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.05 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.06 INFORMATIONAL SUBMITTALS

- A. A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.

4. Coordination of Owner's continuing occupancy of portions of existing building.
- B. Predemolition Photographs: Submit before Work begins.
- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.07 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.08 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. BConditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Owner will remove portions of existing walls, electrical and mechanical items prior to start of selective demolition.
- D. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.

1.09 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
 1. Roofing.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
 - 2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.

3.04 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
- B. Removed and Reinstalled Items:
 1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section "075423 – Thermoplastic Polyolefin (TPO) Roofing" for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

**SECTION 032000
CONCRETE REINFORCING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI MNL-66 - ACI Detailing Manual; 2020.
- C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- D. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2019.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018, with Editorial Revision.
- F. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.
- G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI MNL-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301.

PART 2 PRODUCTS**2.01 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
 - 1. Unfinished.
- B. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4)- Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION**3.01 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as follows:
 - 1. Footings and Concrete Formed Against Earth: 3 inch (76.2 mm).
 - 2. Slabs on Fill: 2 inch (50.8 mm).
- E. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION 032000

**SECTION 033000
CAST-IN-PLACE CONCRETE**

PART 1 – GENERAL**1.01 SUMMARY**

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Curing Concrete Footing, Foundations & Slabs.
 - 3. Sealing Concrete Floor Slabs where scheduled on Finish Schedule.
 - 4. Slabs-on-grade; both exterior slabs and building interior slabs.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 Concrete Reinforcing.
- B. Section 03 3511 Concrete Floor Finishes.
- C. Section 07 9005 Joint Sealers.

1.03 DEFINITIONS

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

1.04 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- E. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2010.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2011.
- G. ASTM C150 - Standard Specification for Portland Cement; 2011.
- H. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2010b.
- I. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- J. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Welding certificates.
- E. Qualification Data: For Installer and manufacturer.
- F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- G. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Bonding agents.
 - 6. Adhesives.
 - 7. Semirigid joint filler.
 - 8. Joint-filler strips.
 - 9. Repair materials.
 - 10. Steel producer's certificates of mill analysis including physical and chemical analysis of reinforcing steel.
- H. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- I. Field quality-control test and inspection reports.
- J. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. Installer is to have completed concrete Work with a minimum of 10 year record of successful in-service performance and similar in material, design, and extent to that indicated for this Project.
 - 1. Submit copy of Flatwork personnel certifications and years' experience for each with current firm and other firms.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Sections 1 through 5 and Section 7, "Lightweight Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- F. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect. For any exposed concrete walls, configure the Class A tolerance wall to include one 90 degree outside chamfered corner, one cold construction joint, one form joint, and other features as may be applicable.
2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.
3. Demolish mockup and remove from site when directed by Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.08 COORDINATION

1.09 GUARANTEE

- A. Special Guarantee: On form approved by Architect, without monetary limitation, in which manufacturer agrees to promptly repair or replace all components of concrete that fails in materials or workmanship, including material and labor, within specified guarantee period.
 1. Failures include pitting, spalling, cracking, honeycombing, surface color and texture irregularities, air bubbles, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Failure includes installation that does not provide indicated slope to drain. Immediately repair or replace concrete and place in satisfactory in every particular, any guaranteed work upon written notice from the Architect and make good all damage to the buildings and grounds caused by said work, without cost to the Owner.
 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Guarantee for New Replacement Work: Provide similar, new 2-year guarantee from date of completion of replacement work.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, Type I, gray.
- B. Test aggregate for the mix for expansion in accordance with AASHTO T 303.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size: 3/4 inch (19.05 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 3. Do not use aggregates containing soluble salts or other substances such as iron sulphides, pyrite, marcasite, or ochre which can cause stains on concrete surfaces.
- D. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size. E. Water: ASTM C94/C94M and potable.

2.03 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.

- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Water-Reducing Accelerating Admixture: ASTM C494/C494M, Type E.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.
 - 1. Products:
 - a. Boral Material Technologies, Inc.; Boral BCN.
 - b. Euclid Chemical Company (The); Eucon CIA.
 - c. Rheocrete CNI.
 - d. Sika Corporation; Sika CNI.
- D. Lithium Admixture: Lithium compound admixture that produces a concrete mix with a linear expansion at 14 days not exceeding 0.10 percent when tested in accordance with ASTM C 1567. Lithium Admixture shall be used on an as-needed basis in order to mitigate alkali silica reactivity and to meet the strength requirements of paragraph 2.13 of this Section. Alkali silica reactivity will be basis for concrete work rejection.

2.04 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products:
 - a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
 - b. Euclid Chemical Company (The); Eucobar.
 - c. L&M Construction Chemicals, Inc.; E-Con.
 - d. MBT Protection and Repair, Div. of ChemRex; Confihn.
 - e. Metalcrete Industries; Waterhold.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Liquid Membrane-Forming Curing Compound: ASTM C309, Type I, Class A, moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.
 - 1. Products:
 - a. Anti-Hydro International, Inc.; A-H 3 Way Sealer.
 - b. Burke by Edoco; Spartan-Cote.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conspec #1.
 - d. Euclid Chemical Company (The); Eucocure.
 - e. L&M Construction Chemicals, Inc.; L&M Cure R.
 - f. MBT Protection and Repair, Div. of ChemRex; Masterkure.
 - g. W.R. Meadows, Inc.; CS-309.
 - h. Metalcrete Industries; Seal N Kure.
 - i. Sonneborn, Div. of ChemRex; Kure-N-Seal

2.05 SEALING MATERIALS

- A. Concrete slab sealer manufactured for cured, dry concrete.

B. Products:

1. Sikagard 701W, by Sika Corporation or pre-bid approved equal.

2.06 RELATED OR ACCESSORY MATERIALS

- A. Slab edge expansion joints: Polyfoam # PF-H50, 6 inch (152.4 mm) x 1/2" with a pre-scored, removable top piece for slab to wall sealant application. Product by Superior Profiles or equal.
- B. Cold or Construction Joints: Keyway # 21-KW- 10, re-usable polyethylene keyway strip.
 1. Product by Superior Profiles or equal.
- C. Control Joints: Zipstrip # 21-1 1/2 x 10, rigid polystyrene "T" shaped strip for forming straight control joints from wall to wall. After initial set, remove horizontal portion of the "T" and tool edges for sealant application. Product by Superior Profiles or equal.
- D. For uses not otherwise indicated: Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber. Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations as indicated.
- E. Backer Rod: Closed Cell Backer Rod to form a non-absorbent compressible backup for sealant joint backup. Sizes 1/4" to 4" as required. Product by Superior Profiles or equal.
- F. Bonding Agent: ASTM C 1059, Type II, non-redispersable, acrylic emulsion or styrene butadiene.

2.07 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.18 mm) and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (6.35 mm) or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4,100 psi (0.00 kPa) at 28 days when tested according to ASTM C109/C109M.

2.08 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 2. Do not use the same testing agency for field quality control testing.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when warranted by characteristics of materials, job conditions, weather, test results, or other circumstances. Submit laboratory test data for revised mix design and strength results to Architect and obtain Architect's acceptance before using in Work.
 1. Laboratory Trial Batches: When laboratory trial batches are used to select concrete proportions, prepare test specimens as specified in ACI 301 and in accordance with ASTM C 192 and conduct strength tests in accordance with ASTM C 39.
 2. Field Experience Method: When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301.

3. If suitable data from field experience or laboratory trial batches cannot be obtained, concrete proportions may be established by use of the water-cement ratio limits table and the limiting restrictions of ACI 301.
4. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for 2 groups totaling 30 or more tests, representing similar materials and project conditions.
5. Standard Deviation: If standard deviation exceeds 600 psi (4136.86 kPa) or if no suitable records are available, select proportions to produce an average strength of at least 1200 psi (8273.71 kPa) greater than the required compressive strength of concrete.
6. After sufficient experience and test data become available from the job, using ACJ 2 1 4 methods of evaluation, the standard deviation may be reduced when the probable frequency of tests more than 500 psi (3447.38 kPa) below required compressive strength will not exceed 1 in 100, and that the probable frequency of an average of 3 consecutive tests below required compressive strength will not exceed 1 in 100.

2.09 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. General: Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 3500 psi (24131.66 kPa) at 28 days.
 2. Minimum Cementitious Materials Content: 6 1 1 lb/cu. yd.
 3. Slump Limit: 4 inches (101.6 mm), maximum.
 4. Air Content: 6 percent, plus or minus 1 .5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
 1. 1. When air temperature is between 85 and 90 degrees Fahrenheit (32.22 degrees Celsius), reduce mixing and delivery time from 1 - 1/2 hours to 75 minutes; when air temperature is above 90 degrees Fahrenheit (32.22 degrees Celsius), reduce mixing and delivery time to 60 minutes.
 2. Include at least the following information on each batch ticket:
 - a. Name of ready-mix batch plant.
 - b. Serial number of ticket.
 - c. Date and number of truck.
 - d. Name of Contractor.
 - e. Specific designation of job (name and location).
 - f. Volume of concrete (number of cubic yards).
 - g. Time batch was dispensed to truck.
 - h. Reading of revolution counter at first addition of water. Signature or initials of ready-mix representative.
 - i. Signature or initials of ready-mix representative.
 - j. Type and brand of cement.
 - k. Amount of cement (can be indicated by weight or quantity).
 - l. Total water content by producer (can be indicated by weight or quantity).
 - m. Water added by receiver of concrete and his initials (can be indicated by weight or quantity).
 - n. Admixtures and amount of same.

- o. Maximum size of aggregate.
- p. Weights of fine and coarse aggregates.
- q. Indication that all ingredients are as previously certified or approved.

PART 3 – EXECUTION

3.01 COORDINATION

- A. Coordinate the installation of joint materials and other related materials with placement of forms and reinforcing steel.

3.02 PREPARATION

- A. Ensure that all silt, loose rock, and deleterious material has been removed from the building area prior to concrete pouring. Evaluate site prior to bidding to determine if any additional topsoil removal may be required. Do not use this material as fill.
 - 1. Bear all footings on approved sound bedrock or approved lean mix concrete.

3.03 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.
 - 4. Place all sleeves, inserts, anchors and embedded items required for adjoining work, or for its support, prior to concreting.

3.04 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Where concrete construction extends to more than one floor level, extend shoring or reshoring over both stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.
- D. Keep reshores in place a minimum of 28 days after placing upper tier, or longer, if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.05 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.18 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groove tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 3. If joint pattern is not shown, provide joints not exceeding 15 feet (457.2 cm) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays). Show on shop drawings for architect's approval.
 4. Joint fillers and sealants are specified in Section 321373 "Joint Sealants."
 5. Joint fillers and sealants for building applications are specified in Section 079005 "Joint Sealants."
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (12.7 mm) or more than 1 inch (25.4 mm) below finished concrete surface where joint sealants, specified in Section 321373 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.06 CONCRETE PLACEMENT

- A. If concrete of a concrete delivery truck is rejected for any reason, do not allow truck on-site for a minimum of 12 hours after moment of rejection.
- B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Notify other trades to permit installation of their work.
- C. Preparation of Subgrade for Slabs on Grade: Keep subgrade moist but do not allow standing water, mud or soft spots. If temperature where concrete is to be placed is below 50°F, enclose and heat to maintain temperature above 50°F long enough to remove frost from subgrade.
- D. Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- E. Do not allow time between charging of materials in the mixing drum and placement on site to exceed 90 minutes (60 minutes for air-entrained concrete), less for higher temperatures.
- F. Use conveying equipment that conforms to ASTM C 94.
- G. Handle concrete from mixer to place of final deposit as rapidly as practicable.
- H. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and the following. Account for all water added to the concrete mix.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
2. Do not add any water to ready-mix concrete drum unless the following conditions are satisfied:
 - a. Water is added only while the concrete is mixing in the drum.
 - b. Mixing truck is equipped with a revolution counter and a working water meter.
 - c. Delivery ticket provides all information required in this Section so that the total amount of water added to the mix can be determined.
 - d. Provide slurry test and compression tests for all concrete after water is added at site.
- I. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth no deeper than 24 inches (609.6 mm) and to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (152.4 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 3. If a section cannot be placed continuously, locate construction joints as approved a maximum of 30 foot (914.4 cm) on center.
 4. Do not allow concrete to free fall over 4 feet (121.92 cm).
 5. Deposit concrete as near as possible to its final position to avoid segregation due to rehandling or flowing.
 6. Clean and dampen hardened concrete surfaces to receive fresh concrete.
- J. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly, 1/8-inch per foot minimum, to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.07 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and straighten until surface is free of trowel marks and uniform in texture and appearance. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces to be covered with fluid-applied waterproofing.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked surface:
 - a. Specified overall values of flatness, F(f) 45

3.08 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hotweather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least [12] inches (304.8 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Begin curing operations immediately after placement. Protect concrete from premature drying, excessively hot or cold temperatures, mechanical injury or vandalism.
- F. Stain Prevention: Use special care to prevent petroleum and other stains from forming on concrete surfaces. Comply with at least the following:
 - 1. Diaper all hydraulic powered equipment to avoid staining of concrete.
 - 2. Do not allow vehicles to park on the interior slabs if avoidable. If vehicles are necessary to complete scope of work, place drop cloths below vehicles at all times.
 - 3. Do not use pipe cutting machines on interior floor slabs.
 - 4. Avoid rust staining. Do not allow steel to be placed on interior slab.

3.09 CONCRETE SEALING

- A. Scope: All concrete slabs under roof covering, interior of buildings or those exposed to animal waste shall be sealed after concrete is cured.
- B. Follow manufacturers instructions.
- C. Apply sealant to dry and clean surface prior to allowing any soiling or traffic on the surface.
- D. Apply a sandblast or high pressure water wash or other mechanical means to remove any glaze or soiling of the surface.
- E. Apply sealant by brush, roller or spray to a coverage stipulated in manufacturers literature. F. Protect applied material for at least 72 hours.

3.10 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six months unless otherwise approved by Architect to meet schedule requirements. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50.8 mm) deep in formed joints.
 - 1. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/4 inch (6.35 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete, but not less than 1 inch (25.4 mm) in depth. Make edges of cuts perpendicular to concrete surface. Thoroughly clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form tie voids with patching mortar or cone plugs secured in place with bonding agent. Place patching mortar before bonding agent has dried. No featheredge will be permitted.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as slabs, for finish smoothness and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a proprietary repair underlayment when acceptable to Architect. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Repair defective areas, except random cracks and single holes 1 inch (25.4 mm) or less in diameter, by cutting out and replacing with fresh concrete.

- Remove defective areas with clean, square cuts and expose steel reinforcement with at least a
- a. 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture
 - b. as original concrete except without coarse aggregate. Place, compact, and finish to blend
 - c. with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Repair random cracks and single holes 1 inch (25.4 mm) or less in diameter with patching mortar.
- a. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.
- G. Where parging may be required, alignment, color and texture must match adjacent concrete and be approved by the Architect.
- H. Architectural Concrete: Use special care repairing concrete exposed to view. Comply with the following:
1. Protect corners, edges, and surfaces of architectural concrete from damage; use guards and barricades.
 2. Protect architectural concrete from staining, laitance, and contamination during remainder of construction period.
 3. Clean architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
 4. Wash and rinse architectural concrete surfaces according to concrete finish applicator's written recommendations. Protect other Work from staining or damage due to cleaning operations.
 5. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 1 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C173/C173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 degrees Fahrenheit ([4.44 degrees Celsius) and below and when [80] degrees Fahrenheit ([26.67] degrees Celsius) and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3447.38 kPa).
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate does not comply.
- D. Measure slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000

**SECTION 033511
CONCRETE FLOOR FINISHES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Polished concrete floor system

1.02 RELATED REQUIREMENTS

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

1.03 1.03 REFERENCES

- A. ASTM E 1155 - Standard Test Method for Determining F(f) (floor flatness) and F(l) (floor levelness)
- B. ASTM C 1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pul-Meter Method
- C. ASTM D523 - Standard Test Method for Specular Gloss

1.04 1.04 SYSTEM DESCRIPTION

- A. Installation of polished concrete for new interior concrete floor by dry grinding and polishing with various sized grit metal-bonded and resin-bonded diamonds, application of concrete densifier, shine enhancer.
- B. Performance requirements: Improve performance of floor by installation of polished concrete floor system as measured by the following
 1. Static Coefficient of Friction, ASTM C 1028:
 - a. Dry Surface: 0.60 b. Wet Surface: N/A
 2. Specular Gloss/Reflectance, ASTM D523:
 - a. 60 degrees
 3. Floor Surface Profile, ASTM E 1155
 - a. F(f): 45

1.05 ADMINISTRATIVE REQUIREMENTS

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

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
- C. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE**1.08 MOCK-UP**

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet (304.8 cm) square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (243.84 cm) above the floor surface over each 20 foot (609.6 cm) square area of floor being finished.

- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees Fahrenheit (10 degrees Celsius) minimum.

1.11 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

- A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

2.02 POLISHED CONCRETE SYSTEM

- A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.
- B. Aggregate Exposure:
 - 1. Class B: Fine Aggregate (Salt and Pepper Finish)
- C. Concrete Densifier (Basis of Design):
 - 1. Liquid Hardener/Densifier:
 - a. LIQUI-HARD ULTRA; W. R. Meadows, Inc
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Concrete Enhancer (Basis of Design):
 - 1. Water-Based, Synthetic Polymer Concrete Floor Enhancer:
 - a. Bellatrix Concrete Enhancer; W. R. Meadows, Inc
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Related Materials:
 - 1. Potable Water
 - 2. Cleaner conditioner or neutral PH detergent

PART 3 EXECUTION

3.01 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.

3.02 GENERAL

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

3.03 COATING APPLICATION

- A. 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.
- B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 CONCRETE POLISHING

- A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
 - 1. Final Polished Sheen: Satin finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not.

2. Satin Finish: Reflecting images from side lighting.
- B. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION 033511

**SECTION 051200
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Structural steel framing members.
- B. Structural steel support members and struts.
- C. Base plates, shear stud connectors and expansion joint plates.
- D. Grouting under base plates.

1.02 1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN)- Steel Construction Manual; 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- E. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2013 (Reapproved 2018).
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- G. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- H. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- I. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
- J. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2018.
- K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi 120464 psi (830 MPa) and 150 ksi (150943 psi (1040 MPa)) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- M. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- O. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.
- P. RCSC (HSBOLT)- Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2014, with Errata (2015).

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, openings, attachments, and fasteners.
 - 2. Connections not detailed.

3. Indicate cambers and loads.
 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN)"Steel Construction Manual."
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- 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.

PART 2 PRODUCTS

2.01 MATERIALS

- A. ASteel 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. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- F. Pipe: ASTM A53/A53M, Grade B, Finish black.
- G. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
- H. Headed Anchor Rods: ASTM F1554, Grade 36, plain.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.02 FABRICATION

- A. A. Shop fabricate to greatest extent possible.
1. 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 2. B. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.
- B. Fabricate connections for bolt, nut, and washer connectors.
- C. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings
- D. Develop required camber for members.
- E. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.03 FINISH

1. A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

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 AISC 303.
- 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 and installation of permanent bracing.
- 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 (6.35 mm) per story, non-cumulative.
- B.

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT)"Specification for Structural Joints Using High-Strength Bolts," testing at least percent of bolts at each connection.
- C. Welded Connections: Visually inspect all field-welded connections according to AWS D1.1

END OF SECTION 051200

**SECTION 055000
METAL FABRICATIONS**

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Steel framing and supports for operable partitions.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Section 051200 "Structural Steel Framing."

1.02 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work.
 - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for operable partitions.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Delegated-Design Submittal: Only for ladders whose design varies significantly from that which is indicated in the contract documents, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer. B. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Only as required per 1.4.B, engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with
 - 1. ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- D. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated. F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 mm).
- G. Sheet Metal: ASTM A36/A36M.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
- E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- F. Post-Installed Anchors: Torque-controlled expansion anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.04 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20684.28 kPa).

2.05 FABRICATION, GENERAL

- A. AShop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.79 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (38 mm), with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches (203.2 mm) from ends and corners of units and 24 inches (609.6 mm) o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.07 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches (152.4 mm) from ends and 24 inches (609.6 mm) o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50.8 mm) larger than expansion or control joint.
- B. Galvanize and prime shelf angles located in exterior walls.
- C. C. Prime shelf angles located in exterior walls with zinc-rich primer.

2.08 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor plate of thickness indicated below:
 - 1. Thickness: 1/4 inch (6.35 mm).

2.09 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No.3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No.3, "Commercial"
 - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: Two coats of clear lacquer.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions, overhead doors and overhead grilles securely to, and rigidly brace from, building structure.
- C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

**SECTION 061000
ROUGH CARPENTRY****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. REFERENCE STANDARDS
- B. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); 2012 (Reaffirmed 2021).
- C. ASME B18.6.1 - Wood Screws (Inch Series); 1981 (Reaffirmed 2016).
- D. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. PS 1 - Structural Plywood; 2023.
- G. PS 20 - American Softwood Lumber Standard; 2025.
- H. Drawings and general provisions of the Contract, including General and Supplementary
 - 1. Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Rooftop equipment bases and support curbs.
 - 3. Wood blocking, cants, and nailers.
 - 4. Plywood backing panels.

1.03 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches (50.8 mm) nominal or greater but less than 5 inches (127 mm) nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. RIS: Redwood Inspection Service.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation.
 - 1. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS**2.01 WOOD PRODUCTS, GENERAL**

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.02 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (320.04 cm) beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all rough carpentry unless otherwise indicated.

2.03 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
 - 1. Hem-fir (north); NLGA.
 - 2. Mixed southern pine; SPIB.

3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
 7. Northern species; NLGA.
 8. Eastern softwoods; NeLMA.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.04 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels and Wall Panels Behind FRP: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406.4 mm) o.c.
- E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.03 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064116
PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. REFERENCE STANDARDS
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- D. BHMA A156.9 - Cabinet Hardware; 2020.
- E. BHMA A156.11 - American National Standard for Cabinet Locks; 2024.
- F. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.
- G. BHMA A156.18 - Standard for Materials and Finishes; 2020.
- H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- I. Drawings and general provisions of the Contract, including General and Supplementary
 - 1. Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
 - 3. Banquette and fabric clad cushions.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 2. Section 123661 "Solid Surfacing Countertops"

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
 - 2. PVC edge material.
- D. Samples for Verification:
 - 1. Plastic laminates, minimum 2" x 3", for each type, color, pattern, and surface finish.
 - 2. Edge Banding: Minimum 6" long strip for each type,color.
 - 3. Exposed cabinet hardware and accessories, one unit for each type.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees Fahrenheit (32.22 degrees Celsius) and relative humidity between 25 and percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS**2.01 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS**

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay. E. Reveal Dimension: 1/2 inch (12.7 mm).
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation (Design Basis).

- b. Panolam Industries International, Inc.
 - c. Wilsonart International; Div. of Premark International, Inc.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: PVC edge banding, 0.12inch thick, matching laminate in color, pattern, and finish.
- G. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- H. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3.05 mm) thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. cFor semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- I. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
- L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Design Basis equal to: Formica, 86992-58 Hardrock Maple matte finish.

2.02 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2 ,Grade M-2-Exterior Glue.

2.03 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:
 - 1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
 - 2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self closing.

- D. Back-Mounted Pulls: BHMA A156.9, B02011.
- E. Wire Pulls: Back mounted, solid metal, 4 inches (101.6 mm) long, 5/16 inch (7.94 mm) in diameter.
- F. Catches: Magnetic catches, BHMA A156.9, B03141.
- G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- H. Shelf Rests: BHMA A156.9, B04013; metal.
- I. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension zinc-plated steel with polymer rollers.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
 - 3. For drawers not more than 3 inches (76.2 mm) high and not more than 24 inches (609.6 mm) wide, provide Grade 2.
 - 4. For drawers more than 3 inches (76.2 mm) high but not more than 6 inches (152.4 mm) high and not more than [24] inches ([609.6] mm) wide, provide Grade 1.
 - 5. For drawers more than 6 inches (152.4 mm) high or more than 24 inches (609.6 mm) wide, provide Grade 1HD-100.
- J. Door Locks: BHMA A156.11, E07121.
- K. Drawer Locks: BHMA A156.11, E07041.
- L. Door and Drawer Silencers: BHMA A156.16, L03011.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- O. Standoffs (for metal panels at reception.): Equal to Gifford standoff systems SO9200BL 1" Diameter, 2" long, machined aluminum in black Anodized finish. Provide all hardware for install including matching cap.
- P. French Cleats: Provide hardware (flush mount concealed) to permanently secure metal accent panels at front reception counters. Provide appropriate gauge for weight of panels.

2.04 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Do not use adhesives that contain urea formaldehyde.

2.05 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.02 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch (3.18 mm) in 96 inches (2438.4 mm).
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 1. Install cabinets with no more than 1/8 inch (3.18 mm) in 96-inch sag, bow, or other variation from a straight line.

3.03 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.

END OF SECTION 064116

**SECTION 079005
JOINT SEALERS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Preparing sealant substrate surfaces. B. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashings and Trim: Sealants used in conjunction with metal flashings.

1.03 REFERENCE STANDARDS

- A. ANSI/ASTM D 1 056 - Flexible Cellular Materials - Sponge or Expanded Rubber. B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 201 3.
- B. FS TT-S-00230 - Sealing Compound: Elastomeric Type, Single Components.
- C. SWI (Sealing and Waterproofers Institute) - Sealant and Caulking Guide Specification
- D. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam
1. (Closed-Cell); 2005 (Reapproved 201 1).

1.04 SUBMITTALS

- A. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- C. Conform to Sealant and Waterproofers Institute requirements for installation.

1.06 FIELD CONDITIONS

- A. Install sealants during periods of proper temperature and humidity as recommended by the sealant manufacturer during and after installation.

1.07 SEQUENCING AND SCHEDULING

- A. Coordinate work under provisions of Section 01 005.
- B. Coordinate the work of this Section with all Sections referencing this Section.

PART 2 PRODUCTS**2.01 SEALANTS**

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound
- B. Polyurethane Sealant: FS TT-S-00230, Type II - non-sag, Class A; color as selected.
1. "Chem-Calk 900" by Bostik
2. "Vulkem 921 " by Mameco International Inc.
3. "Sikaflex - 15LM" by Sika Corp.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Backing: Round foam rod compatible with sealant; ASTM D1667, closed cell PVC; oversized
1. 30 to 50 percent larger than joint width.
- C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work and field measurements are as shown on drawings and recommended by the manufacturer.
- B. Beginning of installation means installer accepts existing surfaces and/or substrate. C. 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.
- B. Perform preparation in accordance with manufacturer's instructions and ASTM C1193
- C. Protect elements surrounding the work of this section from damage or disfigurement.

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. Measure joint dimensions and size materials to achieve required width/depth ratios.
- D. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width. Install bond breaker where joint backing is not used.
- 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 and as detailed. Slope surfaces to drain where applicable.

3.04 CLEANING

- A. Clean work under provisions of Section 01 700. B. Clean adjacent soiled surfaces.
- B. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION 079005

**SECTION 081113
HOLLOW METAL DOORS AND FRAMES**

1.01 REFERENCE STANDARDS**PART 1 GENERAL****2.01 SECTION INCLUDES**

- A. Steel frames

2.02 RELATED SECTIONS

- A. Division 08 Section "Flush Wood Doors"
- B. Division 08 Section "Door Hardware"
- C. Division 08 Section "Glazing"
- D. Division 09 9000 Section "Painting and Coating"

2.03 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 924 - Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
 - 3. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, High Strength Low-Alloy, High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - 4. ASTM E90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - 5. ASTM E413 - Classification for Rating Sound Insulation.
- B. ANSI - American National Standards Institute
 - 1. ANSI/DHI A115 - Specifications for Hardware Preparations in Standard Steel Doors and Frames.
 - 2. ANSI/DHI A115.IG - Installation Guide for Doors and Hardware.
 - 3. ANSI A156.7 - Hinge Template Dimensions.
 - 4. ANSI A 250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing.
 - 6. ANSI A 250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.
 - 7. ANSI A 250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 8. ANSI/SDI 250.11 - Recommended Erection Instructions for Steel Frames
- C. SDI - Steel Door Institute
 - 1. SDI 105 - Recommended Erection Instructions for Steel frames.
 - 2. SDI 111 - Recommended Details and Guidelines for Standard Steel Doors and Frames and Accessories.
 - 3. SDI 112 - Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames.
 - 4. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
 - 5. SDI 118 - Basic Fire Door Requirements.
 - 6. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - 7. SDI 124 - Maintenance of Standard Steel Doors and Frames.
- D. NAAMM/HMMA - Hollow Metal Manufacturers Association
 - 1. HMMA 840 - Guide Specification for Installation and Storage of Hollow Metal Doors and Frames

2. HMMA 820 TN01- Grouting Hollow Metal Frames
 3. HMMA 820 TN03 – Guidelines for Glazing of Hollow Metal Transom, Sidelight and Windows
- E. Building Code references
1. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
 2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives
 3. NFPA 252 – Standard Method of Fire Tests of Door Assemblies
 4. ANSI/UL 10C - Standard for Safety for Positive Pressure Fire Tests of Door Assemblies
 5. UL 1784 - Air Leakage Tests of Door Assemblies
 6. UL - Building Materials Directory; Underwriters Laboratories Inc
 7. WH - Certification Listings; Warnock Hersey International Inc.
 8. Federal Emergency Management Agency (FEMA) 361 Guidelines
 9. IBC 2018 – International Building Code

2.04 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Doors and frames: conform to applicable codes for fire ratings. It is the intent of this specification that door hardware and its application comply or exceed the standards for labeled openings. In case of conflicts in required fire protection ratings, provide fire ratings as required by NFPA and UL 1.
1. Fire door assemblies in exit enclosures and exit passageways: maximum transmitted temperature end point of not more than 250°F (121°C) above ambient at the end of 30 minutes of the standard fire test exposure.

2.05 SUBMITTALS

- A. Submit for review one (1) complete copies of the hollow metal shop drawings covering complete identification of items required for the project. Include manufacturer's names and identification of product. Included one (1) complete copies of catalog cuts and/or technical data sheets and other pertinent data as required to indicate compliance with these specifications.
1. Shop Drawings: submit complete and detailed with respect to quantities, dimensions, specified performance, and design criteria, materials and similar data to enable the Architect to review the information as required.
- B. Indicate frames configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, to ensure doors and frames are properly prepared and coordinated to receive hardware.
- C. Indicate door elevations, internal reinforcement, closure method, and cutouts for glass lights and louvers.
- D. Submit manufacturer's installation instructions, including a current copy of ANSI A250.11 as part of the shop drawing submittal.
- E. Shop drawings, product data, and samples: stamp with Contractor's stamp verifying they have been coordinated and reviewed for completeness and compliance with the contract documents.
- F. Shop drawings submitted without the above requirements will be considered incomplete, will NOT be reviewed, and will be returned directly to the Contractor.
- G. Follow the same procedures for re-submittal as the initial submittal with the appropriate dates revised.
- H. Provide evidence of manufacturer's membership in the Steel Door Institute.

2.06 QUALITY ASSURANCE

- A. Select a qualified hollow metal distributor who is a direct account of the manufacturer of the products furnished. In addition, that distributor must have in their regular employment an Architectural Hardware Consultant (AHC), a Certified Door Consultant (CDC) or an Architectural Openings Consultant (AOC), who will be available to consult with the Architect and Contractor regarding matters affecting the door and frame opening.

- B. Conform to requirements of the above reference standards. Submit test reports upon request by the Owner or Architect.
- C. Underwriters' Laboratories and Intertek Testing Services / Warnock Hersey, labeled fire doors and frames:
 - 1. Label fire doors and frames listed in accordance with Underwriters Laboratories standard UL 10C, and Positive Pressure Fire Tests of Door Assemblies.
 - 2. Construct and install doors and frames to comply with applicable issue of ANSI/NFPA 80.
- D. Manufacturer Qualifications: Member of the Steel Door Institute.
- E. Installer: Minimum five years documented experience installing products specified in this Section.

2.07 DELIVERY, STORAGE, AND HANDLING

- A. Storage of Doors
 - 1. Store doors vertically in a dry area, under proper cover. Place the units on at least 4" high wood sills on floors in a manner that will prevent rust and damage. Avoid storage in non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. If the door becomes wet, or moisture appears, remove protective wrapping immediately. Provide a 4" space between the doors to permit air circulation. Proper storage is required to meet the requirements of ANSI/SDI A250.10 and HMMA 840.
- B. Storage of Frames
 - 1. Store frames 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. Store assembled frames in a vertical position, five units maximum in a stack. Provide a 2" space between frames to permit air circulation.
 - 2. Provide proper storage for doors and frames, to maintain the quality and integrity of the factory applied paint, and maintain the requirements of ANSI/SDI A250.10 and HMMA 840.
 - 3. Sand, touch up and clean prime painted surfaces prior to finish painting in accordance with the manufacturer's instructions.

2.08 COORDINATION

- A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.
- B. Coordinate work with frame opening construction, door and hardware installation.
- C. Sequence installation to accommodate required door hardware.
- D. Verify field dimensions for factory assembled frames prior to fabrication.

PART 2 - PRODUCTS

3.01 MANUFACTURERS

- A. Acceptable manufacturers for doors and frames specified are listed below.
 - 1. Steelcraft, Cincinnati, Ohio
 - 2. Curries, Mason City, Iowa
 - 3. Ceco, Milan Tennessee
- B. Provide steel doors and frames from a single manufacturer.

3.02 DOORS:

- A. Construct exterior/interior doors to these designs and gages:
 - 1. Hardware Reinforcements:
 - a. Hinge reinforcements for full mortise hinges: minimum 7 gage 0.180" (4.7mm).
 - b. Lock reinforcements: minimum 16 gage 0.053" (1.3mm).
 - c. Galvannealed doors: include galvannealed hardware reinforcements.

- d. Projection welded hinge and lock reinforcements to the edge of the door. f. Provided adequate reinforcements for other hardware as required.
- 2. Glass moldings and stops (both labeled and non-labeled doors):
 - a. Fabricate glass trim from 24 gage .6mm steel conforming to:
 - b. Trim: identical on both sides of the door.
 - c. Acceptable mounting methods:
- B. Full Flush Type Doors Construction
 - 1. ANSI-A250.4 criteria and tested to 5,000,000 operating cycles.
 - 2. Approved door core constructions:
 - 3. Vertical edge seams: Provide doors with continuous vertical mechanical inter-locking joints at lock and hinge edges with visible edge seams, or a one piece full height 14 gage channel. Apply a continuous bead of structural epoxy in the internal vertical connection.
Edge Seam Options:
 - a. Filled Vertical Edges (F): Continuous vertical mechanical interlocking joint with internal epoxy seal; edge seams epoxy filled and ground smooth.
 - 4. Bevel hinge and lock door edges 1/8 inch (3.18 mm) in 2 inches (50.8 mm). Square edges on hinge and/or lock stiles are not acceptable.
 - 5. Reinforce top and bottom of doors with galvanized 14 gage, welded to both panels. C.
- C. Stile and Rail Doors
 - 1. Tubular stile and rail construction, 1-3/4" 1.77 inch (45 mm) thick and fabricated from 16 gage (0.05 inch (1.3 mm)) from commercial quality carbon steel or galvanized steel. Stiles that extend the full height of the door. Rails are internally welded or permanently mechanically joined to the stiles forming a neat seam on the face. Hot-dip galvanized steel stiles and rails conforming to ASTM A 653, Class A60, 16 gage 0.053" (1.3mm); formed to rectangular tube shape. Approved door core constructions:
 - a. Hinge Stile and Lock Stile: 3 inches (76.2 mm) plus 5/8 inch (15.88 mm) for aluminum glass stop. Top Rail: [3] inches ([76.2] mm) plus [5/8] inch ([15.88] mm) for aluminum glass stop. Intermediate Rails: 3 inches plus [1-1/4] inches ([32] mm) for aluminum stop. Bottom Rail: [10] inches ([254] mm) plus [5/8] inch ([15.88] mm) for aluminum glass stop. Mechanically fastened hairline flush vertical joints.

3.03 DOOR FRAMES:

- A. Construct exterior and metal door frames to these profiles, designs and gages;
 - 1. Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvanized steel, ASTM A 653, Class A60, 16 gage 0.053" (1.3mm) galvanized steel.
 - 2. Interior Frames in stud wall construction: 16 gage 0.053" (1.3mm) cold rolled frames.
 - 3. Include galvanized components and internal reinforcements with galvanized frames.
- B. Flush Frames: Welded with temporary shipping bars. Factory die-mitered corner connections reinforced with four integral tabs to secure and interlock at jambs to head. Frame face width as indicated with 5/8" stops. Frame depths per the architectural door schedule.
 - 1. Provide frames with a minimum of six wall anchors and two adjustable base anchors of manufacturer's standard design.
 - 2. Provide welded 3 sided frames as follows:
 - a. Face welded: Weld miter joints between head and jamb faces completely along their length either internally or externally. The remaining elements of the frame profile (soffit, stop and rabbets) are not welded. Grind and finish face joints smooth.
 - 1) Weld-in base anchor attaching plate in each jamb for field installation of loose base anchors to allow proper anchoring at base of frame.
- C. Prepare frames to receive inserted type door silencers (3) per strike jamb on single doors, and (2) per head for pair of doors. Stick-on silencers are not permitted.
- D. Frame Hardware Reinforcements:
 - 1. Mortise hinge reinforcement: minimum 7 gage 0.180" (4.7mm).

- a. Provide high frequency hinge reinforcement for top hinge on all frames, in accordance with SDI 111-H.
2. Strike reinforcements: minimum 16 gage 0.053" (1.3mm) and prepared for an ANSI-A115.1-2 strike.
3. Closer reinforcement: minimum 14 gage 0.067" (1.7mm) steel.
4. Projection weld hinge and strike reinforcements to the door frame.
5. Provide metal plaster guards for all mortised cutouts.
6. Provide adequate reinforcements for other hardware as required.
7. Include galvanized hardware reinforcements in all galvanized frames.

3.04 FABRICATION:

- A. Face Welded Frames:

3.05 FINISH:

- A. Doors, frames and frame components are required to be cleaned, phosphatized, and finished with one coat of baked-on rust inhibiting prime paint in accordance with the ANSI/SDI A250.10 "Test Procedures and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

PART 3 - EXECUTION:

4.01 INSTALLATION:

- A. Install doors and frames in accordance with Steel Door Institute's recommended erection instructions for steel frames ANSI A250.11.
- B. Install label doors and frames in accordance with NFPA 80.
- C. Remove temporary steel spreaders prior to installation of frames.
- D. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete, remove temporary wood spreaders.
 1. Field splice only at approved locations indicated on the shop drawings. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
- E. Provide full height 3/8" to 1-1/2" thick strip of polystyrene foam blocking at frames requiring grouting where continuous hinges are specified. Apply the strip to the back of the frame, where the hinge is to be installed, to facilitate field drilling or tapping.
- F. Where grouting is required in masonry, provide and install temporary bottom and intermediate wood spreaders to maintain proper width and avoid bowing or deforming of frame members. Refer to ANSI A250.11-2001, Standard.
 1. Hollow Metal Frames to receive grouting: comply with a current copy of ANSI/SDI Standard A250.8, paragraph 4.2.2, whereby grout will be mixed to provide a 4" maximum slump consistency and hand troweled into place. Do not use grout mixed to a thinner, pumpable consistency; this practice is not recommended and not permissible. Refer to HMMA 820 TN01 Grouting Hollow Metal Frames.
- G. Provide a vertical wood brace during grouting of frame at openings over 4'0" wide, to prevent sagging of frame header.
- H. Glaze and seal exterior transom, sidelight and window frames in accordance with HMMA-820 TN03.
- I. Apply hardware in accordance with hardware manufacturers' instructions and Section 087100 DOOR HARDWARE of these Specifications. Install hardware with only factory-provided fasteners. Adjust door installation to provide uniform clearance at head and jambs, to achieve maximum operational effectiveness and appearance.

4.02 ADJUSTING:

- A. Final Adjustments: Adjust operating doors and hardware items just prior to final inspection and acceptance by the Owner and Architect. Leave work in complete and proper operating

condition. Remove and replace defective work, including doors or frames that are damaged, bowed or otherwise unacceptable.

- B. Prime Coat Touch-Up: Immediately after erection, sand smooth rusted or damaged areas of prime coat, and apply touch-up of compatible air-drying primer.

4.03 PROTECTION

- A. Provide protective measures required throughout the construction period to ensure that door and frame units will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 081113

**SECTION 081416
FLUSH WOOD DOORS**

PART 1 - GENERALRELATED DOCUMENTS**1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch (0.25 mm) in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Masonite Architectural, Owens Corning
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.02 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards WDMA I.S. 1A, "Architectural Wood Flush Doors."
 1. Provide Labels indicating that doors comply with requirements of grades specified.
- B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde.
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch midrail blocking, in doors indicated to have exit devices.
 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium, with Grade AA faces.
 2. Species: Red oak.
 3. Cut: Plain sliced (flat sliced).
 4. Match between Veneer Leaves: Book match.
 5. Assembly of Veneer Leaves on Door Faces: Running match.
 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (304.8 cm) or more.

8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
9. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
10. Exposed Vertical Edges: Same species as faces or a compatible species - edge Type A.
11. Core: Particleboard
12. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
13. WDMA I.S. 1A Performance Grade: Extra Heavy Duty.

2.04 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard shape.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.05 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.06 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: WDMA TR-4 conversion varnish.
 3. Staining: Cane. Field Verify.
 4. Sheen: Satin.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.18 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch (3.18 mm) in 2 inches (50.8 mm) at lock and hinge edges.
 - 2. Bevel fire-rated doors 1/8 inch (3.18 mm) in 2 inches (50.8 mm) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

**SECTION 084313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Interior Aluminum-framed storefront, with interior vision glass.
- B. Perimeter sealant.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- B. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013
- C. C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. DHardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees Fahrenheit (4.44 degrees Celsius). Maintain this minimum temperature during and 48 hours after installation.

1.09 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. Glazed System Equal to:
 - 1. Kawneer North America: www.kawneer.com/#sle.
 - 2. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
 - 3. Tubelite, Inc: www.tubeliteinc.com/#sle.
 - 4. PPG Industries, Pittsburgh, PA.
 - 5. Series 945 T by Vistawall, Terrell, TX.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Set to inside of frame stop.
 - 2. Finish Color: Clear Anodized.
- B. Performance Requirements
 - 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Cross-Section: 2 by 4 inch (101.6 mm) nominal dimension.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Perimeter Sealant: Type 1 specified in Section 07 9005.
- D. Glass: Interior glazing as specified in Section 08 8000.
- E. Glazing Gaskets: Type to suit application to achieve air infiltration requirements.
- F. Glazing Accessories: As specified in Section 08 8000.

2.05 FINISHES

- A. Comply with AA DAF-45 for aluminum finishes required.
- B. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 FABRICATION

- A. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

- B. Prepare components to receive anchor devices. Fabricate anchors.
- C. Arrange fasteners and attachments to conceal from view.
- D. Reinforce components internally for door hardware .
- E. Reinforce framing members for imposed loads.
- F. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of sound barrier.
- H. Install hardware using templates provided.
- I. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.79 mm).

3.04 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.05 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.
- C. Protect finished work from damage.

END OF SECTION 084313

SECTION 087100**DOOR HARDWARE****PART 1 - GENERAL****1.01 SUMMARY****A. Section includes:**

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 07 Section "Joint Sealers" for sealant requirements applicable to threshold installation specified in this section.
4. Division 08 Sections:
 - a. "Hollow Metal Doors and Frames"
 - b. "Flush Wood Doors"
5. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
6. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES**A. UL LLC**

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.

- b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
- 5. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
 - 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 - 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
 - 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage ND Series: 10 years
 - 2) Exit Devices
 - a) Von Duprin: 10 years
 - 3) Closers
 - a) LCN 4000 Series: 30 years
 - b. Electrical Warranty
 - 1) Locks
 - a) Schlage: 3 years
 - 2) Exit Devices
 - a) Von Duprin: 3 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
 - 3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. McKinney TB series
 - c. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10 -Owner's Standard
2. Acceptable Manufacturers and Products:
 - a. As approved by owner

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.

2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.05 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Rockwood
 - c. DCI
 - d. Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.06 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
 - c. DCI

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.07 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series -Owner's Standard

2. Acceptable Manufacturers and Products:
 - a. As approved by owner
- B. Requirements:
 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
 2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
 3. Cylinders: Refer to "KEYING" article, herein.
 4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
 5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 8. Provide electrified options as scheduled in the hardware sets.
 9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: Rhodes (RHO)

2.08 EXIT DEVICES

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 98/35A series -Owner's Standard
 2. Acceptable Manufacturers and Products:
 - a. AS approved by owner
- B. Requirements:
 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
 2. Cylinders: Refer to "KEYING" article, herein.
 3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
 5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
 6. Provide exit devices at pool gates with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.

7. Provide flush end caps for exit devices.
8. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Provide exit devices with manufacturers' approved strikes.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.09 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series - Owners standard
2. Acceptable Manufacturers and Products:
 - a. AS approved by owner

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.10 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage Everest 29 D145
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.

- a. Patented Open: cylinder with interchangeable core with open keyway.
- 3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
- 4. Nickel silver bottom pins.

2.11 KEYING

A. Scheduled System:

- 1. Existing factory registered system:
 - a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

- 1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
- 2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series -Owner's Standard
2. Acceptable Manufacturers and Products:
 - a. As approved by owner

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Closers shall be capable of being upgraded by adding modular mechanical or electronic components in the field.

2.13 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
 - c. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button or thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.14 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Rockwood
 - c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.15 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Scheduled Manufacturer:

1. Zero International

B. Acceptable Manufacturers:

1. National Guard
2. Reese
3. Pemko

C. Seals and Gasketing: Provide continuous gasketing on exterior openings, to the head and jams, forming a continuous seal between the door and the frame. Provide smoke, light, or sound gasketing on interior doors where indicated.

1. Provide self-tapping fasteners for aluminum extruded gasketing being applied to hollow metal frames.
 - a. Provide non-corrosive fasteners for all exterior applications.
 - b. Provide security fasteners where indicated.
2. Provide neoprene, EPDM, silicone, or nylon brush inserts as specified in hardware sets. Provide non brush inserts of solid or sponge cell, as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.

- D. Smoke Labeled Gasketing: At all smoke labeled openings, provide smoke listed perimeter gasketing assemblies complying with NFPA 105 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.
- E. Fire Listed Gasketing: Assemblies complying with NFPA 80 that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction for fire ratings indicated based on testing according to UL-10C.
 - 1. Where frame-applied intumescent seals are required by the manufacturer, provide gaskets that comply with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2, Fire Tests of Door Assemblies.
- F. Sound-Rated Gasketing: Provide acoustic gasketing to meet Sound Transmission Class (STC) rating required.
- G. Meeting-Stile Gasketing: Provide meeting-stile gasketing that fastens to the meeting stiles forming a continuous seal when doors are closed.
- H. Door Sweeps or Shoes: Apply to the bottom of the door to close the gap between the door bottom and finished floor or saddle threshold.
 - 1. Provide solid neoprene, EPDM, silicone, or nylon brush type of seal as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.
- I. Automatic Door Bottoms:
 - 1. Provide closed cell sponge, bulb neoprene, or EPDM type of seal as specified in hardware sets.
 - 2. Door bottom to be mortised, semi mortised, or surface mount as with a minimum thickness as specified in hardware sets.
- J. Rain Drips:
 - 1. Provide overhead rain drips for out-swinging hollow metal doors that are not covered against 45 degree blowing rain. Aluminum extrusion to be a minimum of .088 inches thick and extend 2.50 inches from the face of the frame, in anodized finish to match door.
 - 2. Door sweeps or shoes with integral rain drip must meet ADA requirements
- K. Thresholds: Provide threshold units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, and fabricated to accommodate door hardware and fit door frames.
 - 1. Threshold extrusion to be a minimum thickness as specified in hardware sets.

2.16 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

- 1. Hinges at Exterior Doors: BHMA 630 (US32D)
- 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
- 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
- 4. Protection Plates: BHMA 630 (US32D)
- 5. Overhead Stops and Holders: BHMA 630 (US32D)
- 6. Door Closers: Powder Coat to Match

7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- P. Thresholds:
 - 1. Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
 - 2. Aluminum thresholds to be cut-in, and scribed around mullions, frame members, and stops. Do not butt to thresholds. Provide a continuous surface across full width of opening from jamb to jamb.
 - 3. Where aluminum panic-type (rabbeted) thresholds with neoprene inserts are specified, undercut doors as required to properly mate with seal in threshold.
- Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- R. Perimeter Gasketing:
 - 1. Apply to head and jamb, forming seal between door and frame.
 - 2. Install gasketing in a manner eliminating need to cut any seal to install surface mounted hardware. Install compatible mounting bracket for surface mounted hardware unless minimum 1/4 inch thick solid aluminum seals are provided for mounting of surface applied hardware.

- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Abbreviation	Name
B/O	By Others
IVE	H.B. Ives
LCN	LCN Commercial Division
SCH	Schlage Lock Company
TRM	Trimco
VON	Von Duprin
ZER	Zero International Inc

155760 OPT0469417 Version 2

HW SET: 1.0

For use on Door #(s):

60B 80

Each to have:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954B STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-CON	 ⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-NL-06-CON 24 VDC	 ⚡	626	VON
1	EA	MULLION STORAGE KIT	MT54		689	VON
1	EA	FSIC MORTISE HOUSING	20-059		626	SCH
1	EA	FSIC RIM HOUSING	20-079		626	SCH
2	EA	FSIC CORE	23-030 EV D145		626	SCH
2	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULLION SEAL	8780		BK	ZER
2	EA	DOOR HARNESS	CON-P X REQ. LENGTH	⚡		SCH
2	EA	FRAME HARNESS	CON-6W	⚡		SCH
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
2	EA	DOOR CONTACT	BY DIVISION 28	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	⚡		B/O

OPERATION:

DOOR NORMALLY CLOSED AND LOCKED

ENTRY BY CREDENTIAL READER TO TEMPORARILY RETRACT PANIC HARDWARE

DOOR POSITION IS MONITORED BY ACCESS CONTROL

REQUEST TO EXIT IS BUILT INTO PANIC HARDWARE

EGRESS AT ALL TIMES BY PANIC HARDWARE

DOOR IS FAIL SECURE AND REMAINS LOCKED UPON LOSS OF POWER

HW SET: 2.0*For use on Door #(s):*

60C

84C

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-NL-06-CON 24 VDC		626	VON
1	EA	FSIC RIM HOUSING	20-079		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR HARNESS	CON-P X REQ. LENGTH	⚡		SCH
1	EA	FRAME HARNESS	CON-6W	⚡		SCH
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	DOOR CONTACT	BY DIVISION 28	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	⚡		B/O

OPERATION:

DOOR NORMALLY CLOSED AND LOCKED

ENTRY BY CREDENTIAL READER TO TEMPORARILY RETRACT PANIC HARDWARE

DOOR POSITION IS MONITORED BY ACCESS CONTROL

REQUEST TO EXIT IS BUILT INTO PANIC HARDWARE

EGRESS AT ALL TIMES BY PANIC HARDWARE

DOOR IS FAIL SECURE AND REMAINS LOCKED UPON LOSS OF POWER

HW SET: 3.0

For use on Door #(s):

50A

50B

50C

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-NL-06-CON 24 VDC		626	VON
1	EA	FSIC RIM HOUSING	20-079		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	SURFACE CLOSER	4040XP HW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR HARNESS	CON-P X REQ. LENGTH	↗		SCH
1	EA	FRAME HARNESS	CON-6W	↗		SCH
1	EA	CREDENTIAL READER	BY DIVISION 28.	↗		
1	EA	DOOR CONTACT	BY DIVISION 28	↗		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	↗		B/O

OPERATION:

DOOR NORMALLY CLOSED AND LOCKED

ENTRY BY CREDENTIAL READER TO TEMPORARILY RETRACT PANIC HARDWARE

DOOR POSITION IS MONITORED BY ACCESS CONTROL

REQUEST TO EXIT IS BUILT INTO PANIC HARDWARE

EGRESS AT ALL TIMES BY PANIC HARDWARE

DOOR IS FAIL SECURE AND REMAINS LOCKED UPON LOSS OF POWER

HW SET: 4.0

For use on Door #(s):

84B

Each to have:

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 CON TW8		652	IVE
1	EA	ALRMED PANIC HARDWARE	RX-98-EO-ALK-CON (USE HARDWIRED OPTION)		626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	↗		B/O

HW SET: 5.0

For use on Door #(s):

46A

46B

47A

47B

Each to have:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	SET	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2		626	IVE
1	EA	EU STOREROOM LOCK	ND80JDEU RHO 14-042 RX CON 12V/24V DC		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB1/MB2		SP28	IVE
2	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MEETING STILE	8195AA		AA	ZER
1	EA	DOOR HARNESS	CON-P X REQ. LENGTH	⚡		SCH
1	EA	FRAME HARNESS	CON-6W	⚡		SCH
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
2	EA	DOOR CONTACT	BY DIVISION 28	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	⚡		B/O

OPERATION:

DOOR NORMALLY CLOSED AND SECURE.

USER PRESENTS CREDENTIAL MOMENTARILY UNLOCKING OUTSIDE LEVER, USER ROTATES LEVER FOR ENTRY

EGRESS AT ALL TIMES BY INTERIOR LEVER

DOOR POSITION MONITORED BY ACCESS CONTROL

REQUEST TO EXIT IS PART OF THE LOCKSET

HW SET: 6.0

For use on Door #(s):

48B 49B 87A 60A 132 134A

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	DOOR CONTACT	BY DIVISION 28	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	⚡		B/O

OPERATION:

DOOR NORMALLY CLOSED AND SECURE.

USER PRESENTS CREDENTIAL MOMENTARILY UNLOCKING ELECTRIC STRIKE

EGRESS AT ALL TIMES BY INTERIOR LEVER

DOOR POSITION MONITORED BY ACCESS CONTROL

REX BY MOTION SENSOR (IF REQ'D)

HW SET: 7.0

For use on Door #(s):

48A 49A 70 71 72

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP HW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	DOOR CONTACT	BY DIVISION 28	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28	⚡		B/O

OPERATION:

DOOR NORMALLY CLOSED AND SECURE.

USER PRESENTS CREDENTIAL MOMENTARILY UNLOCKING ELECTRIC STRIKE

EGRESS AT ALL TIMES BY INTERIOR LEVER

DOOR POSITION MONITORED BY ACCESS CONTROL

REX BY MOTION SENSOR (IF REQ'D)

HW SET: 8.0

For use on Door #(s):

57A 86

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW CSK		630	TRM
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

HW SET: 9.0

For use on Door #(s):

51	52	53	54	55	56
57	58	59	73	74	75

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	ENTRANCE LOCK	ND53JD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	381A-FLO		A	ZER

HW SET: 10.0

For use on Door #(s):

81 82 83

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HW SET: 11.0*For use on Door #(s):*

84A

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV D145		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

END OF SECTION

**SECTION 088000
GLAZING****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes:
 - 1. Glass for windows doors interior borrowed lites storefront framing.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
 - 1. Section 083613 "Section Doors" for Glazing in Overhead Sectional Doors.

1.03 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.04 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.07 INFORMATIONAL SUBMITTALS**1.08 QUALIFICATION DATA: FOR INSTALLER.**

- A. Product Certificates: For glass.
- B. Sample Warranties: For special warranties.

1.09 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight ???Insert number??? Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.12 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees Fahrenheit (4.44 degrees Celsius).

1.13 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
 - 1. AGC Glass Company North America, Inc.
 - 2. Cardinal Glass Industries.
 - 3. General Glass International.
 - 4. Oldcastle Building Envelope.

5. Pilkington North America Inc.
 6. PPG Industries, Inc.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

2.03 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. AAMA Publications: AAMA GD5G-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- C. Strength: Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.05 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:
1. Polyvinyl butyral interlayer.
 2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 3. Ionomeric polymer interlayer.
 4. Cast-in-place and cured-transparent-resin interlayer.
 5. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

2.06 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.07 GLAZING SEALANTS

- A. General:
 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; Chem-Calk 1250.
 - b. Dow Corning Corporation; 1199.
 - c. GE Advanced Materials - Silicones; UltraGlaze SSG4000.
 - d. May National Associates, Inc.; Bondaflex Sil 200 GPN.
 - e. Polymeric Systems, Inc.; PSI-631.
 - f. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus. i. Sika Corporation U.S.; Sikasil-N Plus US.
 - g. Tremco Incorporated; Proglaze SSG Tremsil 600.

2.08 GLAZING TAPES

- A. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.09 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product

manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1) a. Temperature Change: 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than [50] inches ([1270] mm).
 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers

and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.08 INSTALLATION OF GLAZING FILMS

- A. Clean glass surfaces
- B. Install films on interior of glass surface by following manufacturers written instructions and protect completed work from damage and contamination.

3.09 GLASS SCHEDULE

- A. Glass Type 2: Monolithic glass.
 - 1. Overall Thickness: 1/4 inch (6.35 mm)
 - 2. Lite: Annealed float glass, fully tempered where indicated.
 - 3. Color: Clear

END OF SECTION 088000

**SECTION 092216
NON-STRUCTURAL METAL FRAMING**

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
 - 3. Grid suspension system for gypsum board ceilings.
 - 4. Prefabricated ponywall supports.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
- B. Studs and Runners: ASTM C645.
 - 1. Steel Studs and Runners:
 - 2. Dimpled Steel Studs and Runners:
- C. Slip-Type Head Joints: Where indicated, provide the following:
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
- F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 - 1. Depth: 7/8 inch (22.22 mm).
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: 3/4 inch (19.05 mm).
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22.22 mm), minimum uncoated-metal thickness of 0.018 inch (0.46 mm), and depth required to fit insulation thickness indicated.
- J. Prefabricated Ponywall Support: All welded construction with prepunched guide holes. 34 inch (863.6 mm) height unless noted otherwise.
 - 1. Available Manufacturers:

2.03 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.06 mm) in diameter.
- C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.35 mm) and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches (38 mm).
- D. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than [1/8] inch ([3.18] mm) from the plane formed by faces of adjacent framing.

3.05 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches (1219.2 mm) o.c.
 2. Carrying Channels (Main Runners): 48 inches (1219.2 mm) o.c.
 3. Furring Channels (Furring Members): 16 inches (406.4 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch (3.18 mm) in 12 feet (365.76 cm) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

**SECTION 092900
GYPSUM BOARD****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Sound-attenuation blankets used for interior gypsum board assemblies.
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.03 ACTION SUBMITTALS

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

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. Lafarge North America Inc.

5. National Gypsum Company.
 6. Temple-Inland.
 7. USG Corporation.
- B. Gypsum Board, Type X: ASTM C1396/C1396M.
1. Thickness: 5/8 inch (15.88 mm).
 2. Long Edges: Tapered.

2.04 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

2.05 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 4 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Exterior Applications:
1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.06 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.59 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

5. Multilayer Application:
6. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (406.4 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
7. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
8. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
9. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.04 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use at exposed panel edges.
 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
 1. 1. Cornerbead: Use at outside corners.
 2. 2. LC-Bead: Use at exposed panel edges.

3.05 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.
 3. Level 3: Mechanical and electrical rooms not intended for public use.
 4. Level 4: All exposed to view surfaces.
 - a. Primer and its application to surfaces are specified in Section 099000 "Painting and Coating".
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

3.06 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

**SECTION 095113
ACOUSTICAL PANEL CEILINGS**

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings, and acoustical baffle systems.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (152.4 mm) in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 5. Perimeter moldings.
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels and Baffles: Full-size panels equal to 2 percent of quantity of each type installed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
 - 1. Smoke-Developed Index: 50 or less.

2.02 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.03 ACOUSTICAL PANELS (ACP)

- A. Manufacturers: Subject to compliance with requirements, provide products equal to the following:
 - 1. C2: Manufacturer: Armstrong World Industries.
 - a. Style: Cortega Second Look 2' X 4' #2758
 - b. Edge: angled tegular
 - c. Size: 2'x 4'
 - d. Color: White
 - e. Other Acceptable Manufacturers:
 - 1) USG Ceiling.

- 2) Rockfon.
- 2. C7: Manufacturer: Armstrong World Industries.
 - a. Style: Formations Clouds with 2' X 4' Cortega tiles second look #2758
 - b. Edge: Axiom Vector 6" Inverted; White
 - c. Size: See drawings
 - d. Color: White
 - e. Tile Edge: angled tegular
 - f. Other Acceptable Manufacturers:
 - 1) USG Ceiling.
 - 2) Rockfon.
- 3. C6: Manufacturer: Armstrong World Industries.
 - a. Style: Sound Scape Blades
 - b. Edge: square, standard to product
 - c. Size: 2" thick; 24" O.C; lengths as shown on drawings
 - d. Length: 12'-0"
 - e. Color: Tangerine (TG)
 - f. NRC .090
 - g. Other Acceptable Manufacturers:
 - 1) MD Wall Zintra.
 - 2) Hunter Douglas.
- 4. C5: Manufacturer: Armstrong World Industries.
 - a. Style: Sound Scape Blades
 - b. Edge: square; standard to product
 - c. Size: 2" thick; 24" o.c.; lengths as shown on drawings
 - d. Length: 12'-0"
 - e. Color: Stone (SE)
 - f. NRC .090
 - g. Other Acceptable Manufacturers:
 - 1) MD Wall Zintra.
 - 2) Hunter Douglas.

2.04 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 - 2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
 - 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - 4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch (22.22 mm) wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.
- I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (609.6 mm) o.c. on all cross tees.
- J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.05 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, prelude 15/16" color: white or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.

2.06 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Axiom Vector (inverted) 6"h, white or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. Fry Reglet Corporation.
 - 4. Gordon, Inc.
 - 5. USG Interiors, Inc.; Subsidiary of USG Corporation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. B.Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts,

- eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1219.2 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (203.2 mm) from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches (406.4 mm) o.c. and not more than 3 inches (76.2 mm) from ends, leveling with ceiling suspension system to a tolerance of $\frac{1}{8}$ inch (3.18 mm) in 12 feet (365.76 cm). Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 2. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

**SECTION 096500
RESILIENT FLOORING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Resilient Luxury Vinyl Tile (LVT) flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025a.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.
- D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).
- E. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; 2002.
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.
- G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Concrete Testing Standard: Submit a copy of ASTM F710.
- F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 150 square feet (13.94 square meters) of each type and color.
 - 3. Extra Wall Base: 20 linear feet (12.43 linear meters) of each type and color.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect roll materials from damage by storing on end.

1.05 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS**2.01 LVT FLOORING (BASIS OF DESIGN)**

- A. LVT Flooring: Homogeneous without backing, with color and pattern throughout full thickness.
 - 1. Manufacturers:
 - a. Shaw Contract, style and color per ISU Facility Standards.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Shaw Contract Luxury Vinyl Tile
 - 1. Collection: Color Link 2.5, #4608V
 - a. Field Color (F6): Harmonious, #00104
 - b. Accent Color (F7): Zest, #00668
 - 2. Classification: ASTM F1700 Class III, Type B
 - a. Thickness: 0.098" (2.5 mm)
 - b. Wear Layer Thickness: 20 mil (0.51 mm)
 - c. Size: 7.75" x 48" (197 mm x 1219 mm)
 - 3. Adhesive: Porous & Non-porous Substrates:
 - a. Installation: Direct Glue
 - 1) 4200 Resilient, 4 Gallon
 - 4. Installation Method
 - a. All arrows in the same direction. Planks should have joints offset by at least 6" and staggered to create a random appearance. Tiles should be installed block or staggered; when quarter turned, arrows should alternate.
 - 5. Warranty
 - a. Limited 15 Year Commercial Warranty.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle. Basis of Design.
 - d. Substitutions: See Section 016000 - Product Requirements.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 - 3. Height: 6 inch (150 mm).
 - 4. Thickness: 0.125 inch (3.2 mm).
 - 5. Finish: Satin.
 - 6. Length: Roll.
 - 7. Color: Charcoal.

2.03 ACCESSORIES

- A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.
- B. Moldings, Transition and Edge Strips: Same material as Rubber Base.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with ASTM F710.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Clean substrate.
- D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096500

**SECTION 096813
CARPET TILE****PART 1 GENERAL****0.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.
- B. Removal of existing carpet tile and resilient base.

0.02 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025a.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- D. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

0.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

0.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum 10 years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience and approved by carpet tile manufacturer.

0.05 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS**1.01 MANUFACTURERS**

- A. Specified Standard Basis of Design:
 - 1. Milliken & Company
- B. Acceptable Manufacturers:
 - 1. Substitutions: See Section 01 6000 - Product Requirements.

1.02 MATERIALS

- A. Tile Carpeting: Milliken; manufactured in one color dye lot.
Style: Remix Remastered, Pattern: Backbeat

1. Tile Size: 19.7 by 19.7 inch (50 by 50 mm), nominal.
 2. Color: Vinyl, No Vibe (BKB27).
 3. Dye Method: Digital Dye Infusion
 4. Yarn Type: Nylon Type 6, 6
 5. Tufted Face Weight: 20 oz / yd x 2
 6. Gage: 1/10 inch.
 7. Stitches: 10.3 per inch.
 8. Finished Pile Height: 0.14"
 9. Primary Backing Material: PVC Comfort Plus.
 10. Installation Method: Quarter Turn
- B. Walk-Off Carpet: Mannington
1. Style: Recourse 2
 2. Tile Size: 24 x 24
 3. Color: Bypass Black #1518
 4. Backing: Infinity #5
 5. Construction Type: Patterned Loop.
 6. Face Weight: 38 oz.
 7. Dye Method: Solution.
 8. Installation Method: Monolithic

1.03 ACCESSORIES

- A. Adhesives:
1. Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) .

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates and base as recommended by flooring and adhesive manufacturers. Cut around stacks as shown on drawings. Carpet under stacks shall remain.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.

- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in monolithic pattern, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION 096813

**SECTION 099000
PAINTING AND COATING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of .
- C. Interior Scope: Finish all surfaces exposed to view, **unless fully factory-finished** and as scheduled in Finish Schedule, including the following:
 - 1. Gypsum board walls, soffits, fascias, and ceilings.
 - 2. Misc Metal fabrications.
 - 3. Hollow metal door frames.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically so indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 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. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
- C. **MASTER PAINTERS INSTITUTE (MPI)**
 - 1. Interior Coatings
 - a. MPI 39(2004) Interior Latex-based Wood Primer
 - b. MPI 50(2004) Interior Latex Primer Sealer
 - c. MPI 57(2004) Interior Oil Modified Clear Urethane, Satin
 - d. MPI 77(2004) Epoxy Cold Cured, Gloss
 - e. MPI 79(2004) Marine Alkyd Metal Primer
 - f. MPI 110(2004) W.B. Light Industrial Coating
 - g. MPI 139(2004) High Performance Latex, White and Tints - MPI Gloss Level 3
 - h. MPI 140(2004) High Performance Architectural Latex - Gloss Level 4
 - i. MPI 141(2004) High Performance Semigloss Latex, White and Tint - Gloss Level 5

1.03 DEFINITIONS

- A. Conform to ASTM D 16 for interpretation of terms used in this section.
- B. MPI System Number: The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.
- C. MPI Gloss Levels:

1. MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.
2. Gloss levels are defined by MPI as follows:

a.	Gloss Level	Description	Units	Units
b.	@ 60 degrees	@ 85 degrees		
c.	G1	Matte or Flat	0 to 5	10 max
d.	G2	Velvet	0 to 10	10 to 35
e.	G3	Eggshell	10 to 25	10 to 35
f.	G4	Satin	20 to 35	35 min
g.	G5	Semi-Gloss	35 to 70	
h.	G6	Gloss	70 to 85	
i.	G7	High Gloss		
3. Gloss is tested in accordance with ASTM D 523.

1.04 SUBMITTALS

- A. See Section , 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. Manufacturer's installation instructions.
- C. Samples: Submit paper "draw down" samples, in size, illustrating each color required by ISU's color standards for each finishing product specified.
 1. Where sheen is specified, submit samples in only that sheen.
 2. Allow for approval process, after receipt of complete samples by Architect.
- D. Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.
- E. Samples: Submit painted samples, illustrating selected colors for each color and system selected. Submit on , in size.
- F. Manufacturer's Instructions: Indicate .
- G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 QUALITY ASSURANCE

- A. The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.
- B. MPI "Approved Product List" shall, for purposes of this specification, mean the products to be considered approved must be qualified under the MPI "Detailed Performance" or MPI "Evaluated Performance" definitions.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum years experience.

- D. Applicator Qualifications: Company specializing in performing the work of this section five years documented experience and approved by manufacturer and approved by manufacturer. Submit the following information concerning the applicator.
- E. Samples of specified materials may be taken and tested for compliance with specification requirements.
- F. Sampling Procedure: If indicated, the Architect or Owner's Project Representative may select a product at random from the products that have been delivered to the job site. The Contractor shall provide one liter(one quart) samples of the selected paint materials. The samples shall be taken in the presence of the Architect or designated testing agent, and labeled, identifying each sample. Provide appropriate labels.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame and smoke rating requirements for products and finishes.
- B. Lead Content: Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.
- C. Chromate Content: Do not use coatings containing zinc-chromate or strontium-chromate.
- D. Asbestos Content: Materials shall not contain asbestos.
- E. Mercury Content: Materials shall not contain mercury or mercury compounds.
- F. Silica: Abrasive blast media shall not contain free crystalline silica.
- G. Human Carcinogens: Materials shall not contain ACGIH TLV-BKLT and ACGIH TLV-DOC confirmed human carcinogens (A1) or suspected human carcinogens (A2).

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 and a maximum of , 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: for interiors; for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

- A. See Section 016000 - Product Requirements, for additional provisions.
- B. Supply 1 gallon (4 L) of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer .
 - 1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for .
 - 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
- C. Base Manufacturer: Any Manufacture listed in the specified MPI system which are members or Master Paint Institute (MPI)
 - 1. The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.
- D. Manufacturers - Field-Catalyzed Coatings:
 - 1. Base Manufacturer: Any Manufacture listed in the specified MPI system which are members or Master Paint Institute (MPI).
- E. Substitutions:

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Colors: As indicated on drawings

2.03 PAINT SYSTEMS - INTERIOR

- A. **STEEL, INTERIOR FERROUS & NON-FERROUS**
 - 1. **Steel, Metal;** Ferrous & Non-Ferrous such as door frames.
 - a. Waterborne Light Industrial
 - 1) **MPI INT 5.1R-G35 (SemiGloss)**

	Primer:	Intermediate:	Topcoat:
(a)	MPI 79	MPI 139	MPI 139
(b)	System DFT: ((5 mils) 125 microns)		
- 2) **MPI EXT 5.1C-G5 (SemiGloss) (Unprimed Steel)**
- | | | | |
|-----|--|---------------|--------------|
| (a) | Sandblast existing steel to remove rust and loose paint. Prepare to SP2/SP3. | | |
| (b) | EXT system used due to damp enviroment, earth floor and animals. | | |
| | Primer: | Intermediate: | Topcoat: |
| (c) | MPI 79 | MPI 110 | MPI 110 - G3 |
| (d) | System DFT: ((5 mils) 125 microns) | | |

B. GYPSUM DRYWALL & PLASTER

1. New Wallboard:

- a. Latex
- 1) New; MPI INT 9.2A-G3 (Eggshell) / Existing; MPIRIN 9.2A-G3 (Eggshell)
- | | | | |
|-----|----------------------------------|---------------|----------|
| (a) | Primer: | Intermediate: | Topcoat: |
| (b) | MPI 50 | MPI 52 | MPI 52 |
| (c) | System DFT: (4 mils) 100 microns | | |

2.04 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: filler.
- C. Fastener Head Cover Material: filler.

PART 3 EXECUTION

3.01 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

- A. Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.02 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: percent.
 3. Concrete Floors and Traffic Surfaces: percent.

3.03 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. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
 - 1. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.
 - 2. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.
 - 3. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.
 - 4. Fill minor defects with filler compound. Spot prime defects after repair.
- G. 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 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.
 - 1. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3, SSPC SP 6, or SSPC SP 10. Brush-off blast remaining surface in accordance with SSPC SP 7; Water jetting to SSPC SP 12 WJ-4 may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.
 - 2. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/SSPC SP 12 WJ-3 SSPC SP 10/SSPC SP 12 WJ-2.
- H. 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.
- I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

- A. Coating Application
 - 1. Apply products in accordance with manufacturer's instructions.
 - 2. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.
 - 3. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.
 - 4. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

5. Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.
 6. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.
 7. Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.
 8. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
 9. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
 10. Apply each coat to uniform appearance.
- B. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
1. **Drying Time:** Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
 2. **Primers, and Intermediate Coats:** Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
 3. **Finished Surfaces:** Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- C. **Mixing and Thinning of Paints**
1. Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.
 2. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.
- D. **Two-Component Systems**
1. Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.
- E. **Coating Systems**
1. **Minimum Dry Film Thickness (DFT):** Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 0.038 mm(1.5 mil) each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
 2. **Coatings for Surfaces Not Specified Otherwise:** Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- F. **Coating Systems for Metal**
1. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
 2. **Inaccessible Surfaces:** Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

3. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
4. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 0.038 mm(1.5 mils) DFT immediately prior to application of epoxy or urethane coatings.
5. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.05 FIELD QUALITY CONTROL

- A. See Section - Quality Requirements, for general requirements for field .
- B. Owner will provide field .

3.06 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 SCHEDULE - PAINT SYSTEMS

- A. Gypsum Board: Finish all surfaces exposed to view.
 1. Interior Walls: MPI INT 9.2F - G5, (SemiGloss).
- B. Steel Door Frames: Finish all surfaces exposed to view: MPI EXT 5.1R -G6, (Gloss).
MPE INT 5.1R - G5 (SemiGloss)
- C. Steel Fabrications: Finish all surfaces exposed to view.
 1. Exterior: MPI EXT 5.1R - G6 , (Gloss).
 2. Interior: MPI INT 5.1N - G5, (Semi-gloss).
 - a. Special Coating - at bottom 10 inches of steel embeds per Article 1.01 D.4.a above.

END OF SECTION 099000

**SECTION 102239
FOLDING PANEL PARTITIONS**

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manually operated, acoustical panel partitions.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.

1.03 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient. C. STC: Sound Transmission Class.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, details, and attachments to other work..
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems are attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets. c. Speakers.
 - c. Sprinklers.
 - d. Smoke detectors. f. Access panels.
- B. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - a. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
 - b. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C423, and rated for not less than the NRC indicated.

2.02 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Modernfold, Inc. (Basis of Design: Accoustiseal 932)
 - b. Advanced Equipment Corporation. c. FolDoor.
 - c. Hufcor Inc.
 - d. KWIK-WALL Company. f. Moderco Inc.
 - e. Panelfold Inc.
- B. Panel Operation: Manually operated, paired panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
- E. STC: Not less than 47.
- F. Panel Weight: 10 lb/sq. ft. maximum.
- G. Panel Thickness: Not less than 3 inches (76.2 mm). Panel Materials:
- H. Panel Materials:
 - 1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
 - 2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.

3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.
 - a. Frame Reinforcement: Manufacturer's standard steel or aluminum.
4. Gypsum Board: ASTM C1396/C1396M.
- I. Panel Closure: Manufacturer's standard unless otherwise indicated.
 1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
 2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.
- J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 1. Hinges: Manufacturer's standard.

2.03 SEALS

- A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:
 1. Manufacturer's standard seals unless otherwise indicated.
 2. Seals made from materials and in profiles that minimize sound leakage.
 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous PVC acoustical seal.
- C. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track or PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.
- D. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
 1. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 1 inch (25.4 mm) between retracted seal and floor finish.

2.04 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
- B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.
 1. Total Weight: Manufacturer's standard.
 2. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
 3. Color/Pattern: As selected by Architect from manufacturer's full range.

2.05 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between

bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels and prevent grouping of paired panels along track; finished with factory-applied, decorative, protective finish.
 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Comply with ASTM E557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

3.03 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Verify that safety devices are properly functioning.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

SECTION 102600 WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 092116 - Gypsum Board Assemblies: Wall construction.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Corner Guards:
 - 1. Construction Specialties, Inc; CO-8 Stainless Steel Corner Guard - 3 1/2" wing size : www.c-sgroup.com/#sle.
 - 2. Inpro; Surface Mount Stainless Steel Corner Guard - 3 1/2" wing size: www.inprocorp.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Material: High impact Stainless Steel.
 - 2. Width of Wings: 3 1/2 inches (88.9 mm).
 - 3. Corner: Square.
 - 4. Color: Stainless Steel
 - 5. Length: One piece. Corner Guards are to extend from the top of the wall base to a height of 4 feet and 6 inches above finished floor.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

3.03 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 102600

**SECTION 104400
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Fire extinguishers per Schedule at end of this Section.
- B. Fire extinguisher cabinets per Schedule at end of this Section.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06100 - Rough Framing: Roughed-in & blocking at wall openings.
- B. Section 099123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- 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.

1.06 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS**2.01 FIRE EXTINGUISHERS**

- 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
 - 1. Class 2A.
 - 2. Size 10B:C.
 - 3. Finish: Baked enamel Red color.

2.02 FIRE EXTINGUISHER CABINETS

- A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.
- B. Cabinet Configuration: Semi-Recessed type.
 - 1. Size to accommodate accessories.

- 2. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.
- D. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, outward curved face set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Stainless Steel.
- H. Finish of Cabinet Interior: White colored enamel.

2.03 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

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. Install cabinets plumb and level in wall openings, 48 inches (1219 mm) from finished floor to inside top of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

3.03 FIRE EXTINGUISHER SCHEDULE - LOCATE AS SHOWN ON ARCHITECTURAL PLAN.

- A. Within Semi-Recessed Cabinet.
- B. Corridor E163 within Semi-Recessed Cabinet at north end of corridor 174 (near Corridor E133)

END OF SECTION 104400

**SECTION 123661
SOLID SURFACING COUNTERTOPS**

PART 1 - GENERAL**1.01 SECTION INCLUDES**

- A. Solid surfacing countertops.
- B. Adhesives and sealants.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Submittals.
- B. Section 01 7800 - Closeout Submittals.
- C. Section 05 5000 - Metal Fabrications.
- D. Section 06 1000 - Rough Carpentry.
- E. Division 22 - Plumbing Sections.

1.03 REFERENCES

- A. A. Reference Standards:
 - 1. ANSI Z124.3: American National Standard for Plastic Lavatories.
 - 2. ANSI Z124.6: American National Standard for Plastic Sinks.
 - 3. ASTM C834: Standard Specification for Latex Sealants.
 - 4. ASTM C920: Standard Specification for Elastomeric Joint Sealants.
 - 5. ASTM D256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 - 6. ASTM D570: Standard Test Method for Water Absorption of Plastics.
 - 7. ASTM D638: Standard Test Method for Tensile Properties of Plastics
 - 8. ASTM D696: Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30oC and 30oC with a Vitreous Silica Dilatometer.
 - 9. ASTM D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 10. ASTM D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 11. ASTM D2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 - 12. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 13. ASTM G21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 - 14. ASTM G 22: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.
 - 15. ASTM G155: Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
 - 16. NEMA LD 3: High Pressure Decorative Laminates.
 - 17. NSF/ANSI Standard 51: Food Equipment Materials.
 - 18. SCAQMD Rule 1168: Adhesive and Sealant Applications.
 - 19. UL 2818: GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 3000 - Submittals.
- B. Product Data:
 - 1. Submit product data for each specified product. Include manufacturer's technical data sheets and published instruction instructions.
 - 2. Submit Material Safety Data Sheets (MSDS) for adhesives and sealants.

- C. Shop Drawings:
 - 1. Submit fully dimensioned shop drawings showing countertop layouts, joinery, terminating conditions, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.
- D. Samples:
 - 1. Submit selection and verification samples for each color, pattern, and finish required.
- E. Quality Assurance Submittals:
 - 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.
 - 2. Warranty: Specimen copy of specified warranty.
- F. Maintenance Data: Submit manufacturer's published maintenance manual with closeout submittals.

1.05 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Comply with the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines for Buildings and Facilities.
- B. Adhesives, Sealants, and Sealant Primers:
 - 1. SCAQMD (South Coast Air Quality Management District) Rule 1168.

1.06 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator Qualifications: Minimum of three years documented experience in fabricating solid surfacing countertops similar in scope and complexity to this Project. Currently certified by the manufacturer as an acceptable fabricator.
 - 2. Installer Qualifications: Minimum of three years documented installation experience for projects similar in scope and complexity to this Project, and currently certified by the manufacturer as an acceptable installer. .
- B. Mock-Ups:
 - 1. Mock-Up Size: 12" x 12"
 - 2. Incorporation: If permitted by Architect, mock-up may be incorporated into as part of the completed Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Store sheet materials flat on pallets or similar rack-type storage to preclude damage.

1.08 PROJECT CONDITIONS

- A. A. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- B. Adhesive: Acclimatize adhesives to occupancy room temperatures with maximum temperature not to exceed 75 degrees Fahrenheit (23.89 degrees Celsius).

1.09 WARRANTY

- A. Manufacturer's Limited Warranty: Provide manufacturer's standard 10 Year Commercial
 - 1. Limited Warranty against defects in solid surface sheet materials.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Wilsonart LLC.
- B. Corian by Dupont

2.02 SOLID SURFACE SHEET MATERIAL

- A. Composition: Acrylic resins, fire-retardant mineral fillers, and proprietary coloring agents. Through-the-body color for full thickness of sheet material.
- B. Material Thickness: 1/2 inch (12.7 mm), nominal.
- C. Physical Characteristics:
 - 1. Tensile Strength: 6800 psi (46884.37 kPa); ASTM D638.
 - 2. Tensile Modulus: 1.5 x 10⁶ psi (730.84 kPa); ASTM D638.
 - 3. Tensile Elongation: 0.4 percent minimum; ASTM D638.
 - 4. Flexural Strength: 10,000 psi (68947.60 kPa); ASTM D790.
 - 5. Flexural Modulus: 1.5 x 10⁶ psi (730.84 kPa); ASTM D790.
 - 6. Thermal Expansion Coefficient: 1.37 x 10⁻⁵ inch (2667 mm)/in.oF; ASTM D696.
 - 7. Hardness (Barcol Impressor): 55-62; ASTM D2583.
 - 8. Impact Resistance: 144 inch (3657.6 mm) . drop with no fracture; NEMA LD 3, Method 3.8.
 - 9. Izod Impact: 0.28 (ft-lb.)/in.; ASTM D256, Method A.
 - 10. Light Resistance - Xenon: No effect; NEMA LD 3, Method 3.3.
 - 11. Stain Resistance: Pass; ANSI Z 124.3, modified.
 - 12. Wear and Cleanability: Pass; ANSI Z 124.3.
 - 13. Fungi Resistance: Pass; ASTM G21.
 - 14. Bacterial Resistance: Pass; ASTM G 22.
 - 15. Boiling Water Resistance: No effect; NEMA LD 3, Method 3.5.
 - 16. High Temperature Resistance: No effect; NEMA LD 3, Method 3.6.
 - 17. Weatherability: Delta E less than 5; ASTM G155.
 - 18. Moisture Absorption: Less than 0.25 percent; ASTM D570, long term.
 - 19. Specific Gravity: 1.7 gram/cm³; ASTM D792.
 - 20. Weight: 4.4 lb./ft².
 - 21. Surface Burning Characteristics: Class I and Class A; ASTM E84.
- D. Color, Pattern, and Finish Design: Yukon Riverstone 9196RS.
- E. Edge Detail:
 - 1. Edge Detail: Bevel

2.03 2.4 ACCESSORY MATERIALS

- A. Joint Adhesive: Methacrylate-based adhesive for chemically bonding solid surfacing seams. Color complementary to solid surfacing sheet material. UL 2818 GREENGUARD Gold certified and complies with SCAQMD Rule 1168.
- B. Elastomeric Sealant: Mildew-resistant silicone sealant for filling gaps between countertops and terminating substrates in wet environment applications. Complies with ASTM C920, Type S (single component), Grade NS (nonsag).
 - 1. Product: Acceptable to countertop manufacturer.
 - 2. Color: Complementary to solid surfacing colorSelected from sealant manufacturer's standard offerings.
- C. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates. Complies with ASTM C834, Type OP, Grade NF, and SCAQMD Rule 1168.
 - 1. Color: Complementary to solid surfacing colorSelected from sealant manufacturer's standard offerings.
- D. Construction Adhesive: Countertop manufacturer's recommended silicone-based construction adhesive for backsplashes, endsplashes, and other applications according to manufacturer's published fabrication instructions.

2.04 FABRICATION

- A. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and Wilsonart published fabrication requirements.
- B. Form joint seams between solid surfacing components with specified seam adhesive.
 - 1. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.
- C. Provide holes and cutouts indicated on approved shop drawings. Rout cutouts and complete by sanding all edges smooth.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates and conditions that could adversely affect the work of this Section.
- B. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.
- C. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

3.02 COUNTERTOP INSTALLATION

- A. Install solid surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to manufacturer.
- B. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings and acceptable to manufacturer. Promptly remove excess adhesive.
- C. Provide minimum 1/2 inch (12.7 mm) radius for countertop inside corners.
- D. Fill gaps between countertop and terminating substrates with specified silicone sealant.
- E. Rout sink cutouts to manufacturer's template. Adhere solid surface cast sink units to countertops with specified adhesive.
- F. Install backsplashes and endsplashes where indicated on Drawings. Adhere to countertops with specified construction adhesive.

3.03 REPAIRS

- A. If permissible to Architect, minor surface marring for solid surfacing components may be repaired according to manufacturer's published installation instructions.
- B. Remove and replace solid surfacing components that are damaged and cannot be satisfactorily repaired.

3.04 CLEANING AND PROTECTION

- A. Clean solid surfacing components according to manufacturer's published maintenance instructions. Completely remove excess adhesives and sealants from finished surfaces.
- B. Protect completed work from damage during remainder of construction period.

END OF SECTION 123661

SECTION 22 05 11 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section will apply to all sections of Division 22.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Exterior: Piping and equipment exposed to weather be it temperature, humidity, precipitation, wind or solar radiation.
- C. Abbreviations/Acronyms:
 - 1. ABS: Acrylonitrile Butadiene Styrene
 - 2. AC: Alternating Current
 - 3. ACR: Air Conditioning and Refrigeration
 - 4. A/E: Architect/Engineer
 - 5. AFF: Above Finish Floor
 - 6. AFG: Above Finish Grade
 - 7. AI: Analog Input
 - 8. AISI: American Iron and Steel Institute
 - 9. AO: Analog Output
 - 10. ASHRAE: American Society of Heating Refrigeration, Air Conditioning Engineers
 - 11. ASJ: All Service Jacket
 - 12. ASME: American Society of Mechanical Engineers
 - 13. ASPE: American Society of Plumbing Engineers
 - 14. AWG: American Wire Gauge
 - 15. BACnet: Building Automation and Control Network
 - 16. BAg: Silver-Copper-Zinc Brazing Alloy
 - 17. BAS: Building Automation System
 - 18. BCuP: Silver-Copper-Phosphorus Brazing Alloy
 - 19. bhp: Brake Horsepower
 - 20. Btu: British Thermal Unit
 - 21. Btu/h: British Thermal Unit per Hour
 - 22. BSG: Borosilicate Glass Pipe

- 23. C: Celsius
- 24. CA: Compressed Air
- 25. CD: Compact Disk
- 26. CDA: Copper Development Association
- 27. CGA: Compressed Gas Association
- 28. CFM: Cubic Feet per Minute
- 29. CI: Cast Iron
- 30. CLR: Color
- 31. CO: Contracting Officer
- 32. CPVC: Chlorinated Polyvinyl Chloride
- 33. CR: Chloroprene
- 34. CRS: Corrosion Resistant Steel
- 35. CWP: Cold Working Pressure
- 36. CxA: Commissioning Agent
- 37. dB: Decibels
- 38. db(A): Decibels (A weighted)
- 39. DCW: Domestic Cold Water
- 40. DDC: Direct Digital Control
- 41. DFU: Drainage Fixture Units
- 42. DHW: Domestic Hot Water
- 43. DHWR: Domestic Hot Water Return
- 44. DHWS: Domestic Hot Water Supply
- 45. DI: Digital Input
- 46. DI: Deionized Water
- 47. DISS: Diameter Index Safety System
- 48. DN: Diameter Nominal
- 49. DO: Digital Output
- 50. DOE: Department of Energy
- 51. DVD: Digital Video Disc
- 52. DWG: Drawing
- 53. DWH: Domestic Water Heater
- 54. DWS: Domestic Water Supply
- 55. DWV: Drainage, Waste and Vent
- 56. ECC: Engineering Control Center
- 57. EL: Elevation

- 58. EMCS: Energy Monitoring and Control System
- 59. EOR: Engineer of Record
- 60. EPA: Environmental Protection Agency
- 61. EPACT: Energy Policy Act
- 62. EPDM: Ethylene Propylene Diene Monomer
- 63. EPT: Ethylene Propylene Terpolymer
- 64. ETO: Ethylene Oxide
- 65. F: Fahrenheit
- 66. FAR: Federal Acquisition Regulations
- 67. FD: Floor Drain
- 68. FDC: Fire Department (Hose) Connection
- 69. FED: Federal
- 70. FG: Fiberglass
- 71. FNPT: Female National Pipe Thread
- 72. FOR: Fuel Oil Return
- 73. FOS: Fuel Oil Supply
- 74. FOV: Fuel Oil Vent
- 75. FPM: Fluoroelastomer Polymer
- 76. FSK: Foil-Scrim-Kraft Facing
- 77. FU: Fixture Units
- 78. GAL: Gallon
- 79. GCO: Grade Cleanouts
- 80. GPD: Gallons per Day
- 81. GPH: Gallons per Hour
- 82. GPM: Gallons per Minute
- 83. HDPE: High Density Polyethylene
- 84. HEX: Heat Exchanger
- 85. Hg: Mercury
- 86. HOA: Hands-Off-Automatic
- 87. HP: Horsepower
- 88. HVE: High Volume Evacuation
- 89. Hz: Hertz
- 90. ID: Inside Diameter
- 91. IE: Invert Elevation
- 92. INV: Invert

- 93. IPC: International Plumbing Code
- 94. IPS: Iron Pipe Size
- 95. IW: Indirect Waste
- 96. IWH: Instantaneous Water Heater
- 97. Kg: Kilogram
- 98. kPa: Kilopascal
- 99. KW: Kilowatt
- 100. KWH: Kilowatt Hour
- 101. lb: Pound
- 102. lbs/hr: Pounds per Hour
- 103. LNG: Liquid Natural Gas
- 104. L/min: Liters per Minute
- 105. LOX: Liquid Oxygen
- 106. L/s: Liters per Second
- 107. m: Meter
- 108. MA: Medical Air
- 109. MAWP: Maximum Allowable Working Pressure
- 110. MAX: Maximum
- 111. MBH: 1000 Btu per Hour
- 112. MED: Medical
- 113. MER: Mechanical Equipment Room
- 114. MFG: Manufacturer
- 115. mg: Milligram
- 116. mg/L: Milligrams per Liter
- 117. ml: Milliliter
- 118. mm: Millimeter
- 119. MIN: Minimum
- 120. MV: Medical Vacuum
- 121. N2: Nitrogen
- 122. N2O: Nitrogen Oxide
- 123. NC: Normally Closed
- 124. NF: Oil Free Dry (Nitrogen)
- 125. NG: Natural Gas
- 126. NIC: Not in Contract
- 127. NO: Normally Open

- 128. NOM: Nominal
- 129. NPTF: National Pipe Thread Female
- 130. NPS: Nominal Pipe Size
- 131. NPT: Nominal Pipe Thread
- 132. NTS: Not to Scale
- 133. O₂: Oxygen
- 134. OC: On Center
- 135. OD: Outside Diameter
- 136. OSD: Open Sight Drain
- 137. OS&Y: Outside Stem and Yoke
- 138. PA: Pascal
- 139. PBPU: Prefabricated Bedside Patient Units
- 140. PD: Pressure Drop or Difference
- 141. PDI: Plumbing and Drainage Institute
- 142. PH: Power of Hydrogen
- 143. PID: Proportional-Integral-Differential
- 144. PLC: Programmable Logic Controllers
- 145. PP: Polypropylene
- 146. ppb: Parts per Billion
- 147. ppm: Parts per Million
- 148. PSI: Pounds per Square Inch
- 149. PSIA: Pounds per Square Inch Atmosphere
- 150. PSIG: Pounds per Square Inch Gauge
- 151. PTFE: Polytetrafluoroethylene
- 152. PVC: Polyvinyl Chloride
- 153. PVDF: Polyvinylidene Fluoride
- 154. RAD: Radians
- 155. RO: Reverse Osmosis
- 156. RPM: Revolutions Per Minute
- 157. RTD: Resistance Temperature Detectors
- 158. RTRP: Reinforced Thermosetting Resin Pipe
- 159. SAN: Sanitary Sewer
- 160. SCFM: Standard Cubic Feet per Minute
- 161. SDI: Silt Density Index
- 162. SMACNA: Sheet Metal and Air Conditioning Contractors National Association

- 163. SPEC: Specification
- 164. SPS: Sterile Processing Services
- 165. SQFT/SF: Square Feet
- 166. SS: Stainless Steel
- 167. STD: Standard
- 168. SUS: Saybolt Universal Second
- 169. SWP: Steam Working Pressure
- 170. TD: Temperature Difference
- 171. TDH: Total Dynamic Head
- 172. TEFC: Totally Enclosed Fan-Cooled
- 173. TEMP: Temperature
- 174. TFE: Tetrafluoroethylene
- 175. THERM: 100,000 Btu
- 176. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
- 177. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
- 178. T/P: Temperature and Pressure
- 179. TYP: Typical
- 180. V: Vent
- 181. V: Volt
- 182. VAC: Vacuum
- 183. VAC: Voltage in Alternating Current
- 184. VSD: Variable Speed Drive
- 185. VTR: Vent through Roof
- 186. W: Waste
- 187. WAGD: Waste Anesthesia Gas Disposal
- 188. WC: Water Closet
- 189. WG: Water Gauge
- 190. WOG: Water, Oil, Gas
- 191. WPD: Water Pressure Drop
- 192. WSFU: Water Supply Fixture Units

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 07 84 00, FIRESTOPPING.

- D. Section 07 92 00, JOINT SEALANTS.
- E. Section 09 91 00, PAINTING.
- F. Section 22 07 11, PLUMBING INSULATION.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below will form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
- B. American Society of Mechanical Engineers (ASME):
 - B31.1-2013 Power Piping ASME Boiler and Pressure Vessel Code -
 - BPVC Section IX-2019 Welding, Brazing, and Fusing Qualifications
- C. American Society for Testing and Materials (ASTM):
 - A36/A36M-2019.....Standard Specification for Carbon Structural Steel
 - A575-96(2013)e1 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
 - E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials
 - E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials
- D. International Code Council, (ICC):
 - IBC-2018 International Building Code
 - IPC-2018 International Plumbing Code
- E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
 - SP-58-2018 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation
- F. National Electrical Manufacturers Association (NEMA):
 - MG 1-2016.....Motors and Generators
- G. National Fire Protection Association (NFPA):
 - 51B-2019 Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 54-2018 National Fuel Gas Code
 - 70-2020 National Electrical Code (NEC)

99-2018 Healthcare Facilities Code

H. NSF International (NSF):

5-2019 Water Heaters, Hot Water Supply Boilers, and Heat Recovery
Equipment

14-2019 Plastic Piping System Components and Related Materials

61-2019 Drinking Water System Components – Health Effects

372-2016 Drinking Water System Components – Lead Content

1.4 SUBMITTALS

- A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
- C. Contractor will make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessible from the floor or permanent work platform. It is the Contractor's responsibility to ensure all submittals meet the specifications and requirements and it is assumed that all submittals do meet the specifications unless the Contractor has requested a variance in writing and approved by EOR prior to the submittal. If at any time during the project it is found that any item does not meet the specifications and there was no variance approval the Contractor will correct at no additional cost or time to the Owner even if a submittal was approved.
- D. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical will be the Contractor's responsibility to design, supply, and install at no additional cost or time to the Owner. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, Contractor will certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Submittals and shop drawings for interdependent items, containing applicable descriptive information, will be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.
- G. Manufacturer's Literature and Data including: Manufacturer's literature will be submitted under the pertinent section rather than under this section.
 - 1. Electric motor data and variable speed drive data will be submitted with the driven equipment.

2. Equipment and materials identification.
3. Firestopping materials.
4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
5. Wall, floor, and ceiling plates.

H. Coordination/Shop Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
2. The coordination/shop drawings will include plan views, elevations and sections of all systems and will be on a scale of not less than 1:32 (3/8-inch equal to 1 foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings will clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.

1.5 QUALITY ASSURANCE

- A. Mechanical, electrical, and associated systems will be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems will be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel will be experienced and qualified specialists in industrial and institutional plumbing.
- B. Products Criteria:
1. Standard Products: Material and equipment will be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, will be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
 2. Equipment Service: There will be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations will come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming will be submitted for project record and inserted into the operations and maintenance manual.

3. All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
 4. The products and execution of work specified in Division 22 will conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official will be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code will apply. Any conflicts will be brought to the attention of the Engineer of Record (EOR).
 5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units will be of the same manufacturer and model number, or if different models are required they will be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
 6. Assembled Units: Performance and warranty of all components that make up an assembled unit will be the responsibility of the manufacturer of the completed assembly.
 7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark will be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
- C. Welding: Before any welding is performed, Contractor will submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.
 2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
 3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
 4. All welds will be stamped according to the provisions of the AWS or ASME as required herein and by the association code.
- D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations will be furnished to the EOR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- E. Execution (Installation, Construction) Quality:
1. All items will be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents will be referred to the EOR for resolution. Printed copies or electronic files of manufacturer's installation instructions will be provided to the EOR at least 10 working days prior to commencing installation of any item.
 2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, will be easily and safely accessible by persons

standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to EOR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the EOR will result in the Contractor correcting at no additional cost or time to the Owner.

3. Complete layout drawings will be required by Paragraph, SUBMITTALS. Construction work will not start on any system until the layout drawings have been approved.
 4. Installer Qualifications: Installer will be licensed and will provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
 5. Workmanship/craftsmanship will be of the highest quality and standards. The Owner reserves the right to reject any work based on poor quality of workmanship this work will be removed and done again at no additional cost or time to the Owner.
- F. Upon request by Owner, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.
- G. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions will be considered mandatory, the word "should" will be interpreted as "will". Reference to the "code official" or "owner" will be interpreted to mean the COR.
- I. Cleanliness of Piping and Equipment Systems:
1. Care will be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping will be removed.
 2. Piping systems will be flushed, blown or pigged as necessary to deliver clean systems.
 3. The interior of all tanks will be cleaned prior to delivery and beneficial use by the Owner. All piping will be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets will be flushed of debris prior to final acceptance.
 4. Contractor will be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site will remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.

2. Damaged equipment will be replaced with an identical unit as determined and directed by the EOR. Such replacement will be at no additional cost or additional time to the Owner.
3. Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as required for new work.
5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks will not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

1.7 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions will be //in electronic version on CD or DVD// inserted into a three—ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation will be included in the operation and maintenance manual. The operations and maintenance manual will include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices will be included. A List of recommended spare parts (manufacturer, model number, and quantity) will be furnished. Information explaining any special knowledge or tools the owner will be required to employ will be inserted into the As-Built documentation.
- C. The installing Contractor will maintain as-built drawings of each completed phase for verification; and, will provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it will not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
 1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
- D. The as-built drawings will indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.
- E. Certification documentation will be provided to EOR 21 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results will contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results will include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points,

amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

- A. Building Operation: Owner employees will be continuously operating and managing all facilities, including temporary facilities that serve the Owner.
- B. Maintenance of Service: Schedule all work to permit continuous service as required by the Owner.
- C. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by ISU. Maintain all egress routes and safety systems/devices.
- D. Acceptance of Work for Owner Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Owner, inspections and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Owner personnel.

PART 2 - PRODUCTS

2.1 MATERIALS FOR VARIOUS SERVICES

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead will not be used in any potable water system intended for human consumption and will be certified in accordance with NSF 61 or NSF 372.
- B. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers will comply with NSF 61 and NSF 372.
- C. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

- A. Standardization of components will be maximized to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others will assume complete responsibility for final assembled unit.
 - 1. All components of an assembled unit need not be products of same manufacturer.
 - 2. Constituent parts that are alike will be products of a single manufacturer.
 - 3. Components will be compatible with each other and with the total assembly for intended service.

4. Contractor will guarantee performance of assemblies of components and will repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Owner.
- C. Components of equipment will bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, will be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed will be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS

- A. Pump shafts and couplings will be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material will be minimum 16-gauge sheet steel; ends will be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- B. All Equipment will have moving parts protected from personal injury.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING will be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. will be identified.
- B. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.
- C. Control Items: All temperature, pressure, and controllers will be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.
- D. Valve Tags and Lists:
 1. Plumbing: All valves will be provided with valve tags and listed on a valve list (Fixture stops not included).
 2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
 3. Valve lists: Valve lists will be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) will show valve tag number, valve function and area of control for each service or system. The valve list will be in a punched 3-ring binder notebook. An additional copy of the valve list will be mounted in

picture frames for mounting to a wall. COR will instruct Contractor where frames will be mounted.

4. A detailed plan for each floor of the building indicating the location and valve number for each valve will be provided in the 3-ring binder notebook. Each valve location will be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.6 FIRESTOPPING

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.7 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC)// and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.// Submittals based on the International Building Code (IBC)// and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS// requirements, or the following paragraphs of this Section will be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) will be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.
- B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction:
 1. Concrete insert: Type 18, MSS SP-58.
 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
 1. Welded attachment: Type 22.
 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.
- E. Attachment to Metal Pan or Deck: As required for materials specified in //Section 05 31 00, STEEL DECKING.// //Section 05 36 00, COMPOSITE METAL DECKING.//
- F. For Attachment to Wood Construction: Wood screws or lag bolts.
- G. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles will provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

- H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.
- I. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
 - 1. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.
- J. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
 - 1. General Types (MSS SP-58):
 - a Standard clevis hanger: Type 1; provide locknut.
 - b Riser clamps: Type 8.
 - c Wall brackets: Types 31, 32 or 33.
 - d Roller supports: Type 41, 43, 44 and 46.
 - e Saddle support: Type 36, 37 or 38.
 - f Turnbuckle: Types 13 or 15.
 - g U-bolt clamp: Type 24.
 - h Copper Tube:
 - 1) Hangers, clamps and other support material in contact with tubing will be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
 - 2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
 - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
 - 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
 - i Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending 1 inch beyond steel support or clamp. //Spring Supports (Expansion and contraction of vertical piping):
 - 1) Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
 - 2) Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.//

j Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):

a Horizontal piping: Type 1, 5, 7, 9, and 10.

b Chrome plated piping: Chrome plated supports.

c Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

d Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

2.8 PIPE PENETRATIONS

- A. Pipe penetration sleeves will be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
 - 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 - 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.
- E. Sheet metal, plastic, or moisture resistant fiber sleeves will be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- F. Cast iron or zinc coated pipe sleeves will be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe will be made watertight with a modular or link rubber seal. The link seal will be applied at both ends of the sleeve.
- G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves will be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve will be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves will be connected with a floor plate.
- H. Brass Pipe Sleeves will be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve will be connected with a floor plate.
- I. Sleeve clearance through floors, walls, partitions, and beam flanges will be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation will be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter.

Interior openings will be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

- J. Sealant and Adhesives: Will be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible.
- K. Pipe passing through roof will be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange will extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane will be provided with a clamping flange. The annular space between the sleeve and pipe will be sealed watertight.

2.9 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to ISU, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the EOR.
- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials will be utilized when possible.

2.10 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates will be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint will be provided in spaces where brass or steel pipe sleeves are specified.

2.11 ASBESTOS

- A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions will be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment will be located clear of windows, doors, openings, light outlets, and other services and

utilities. Equipment layout drawings will be prepared to coordinate proper location and personnel access of all facilities. The drawings will be submitted for review.

- B. Manufacturer's published recommendations will be followed for installation methods not otherwise specified.
- C. Operating Personnel Access and Observation Provisions: All equipment and systems will be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators will be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings will not be changed nor reduced.
- D. Structural systems necessary for pipe and equipment support will be coordinated to permit proper installation.
- E. Location of pipe sleeves, trenches and chases will be accurately coordinated with equipment and piping locations.
- F. Cutting Holes:
 - 1. Holes will be located to avoid interference with structural members such as beams or grade beams. Holes will be laid out in advance and drilling done only after approval by EOR. If the Contractor considers it necessary to drill through structural members, this matter will be referred to EOR for approval.
 - 2. Waterproof membrane will not be penetrated. Pipe floor penetration block outs will be provided outside the extents of the waterproof membrane.
 - 3. Holes through concrete and masonry will be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.
 - 4. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.
- G. Protection and Cleaning:
 - 1. Equipment and materials will be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, will be replaced at no additional cost or time to the Owner.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures will be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- H. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, will be used for all pad or floor mounted equipment.
- I. Gauges, thermometers, valves and other devices will be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges will be

located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing will not require dismantling adjacent equipment or pipe work.

- J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but will be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.
- K. Domestic cold and hot water systems interface with the HVAC control system for the temperature, pressure and flow monitoring requirements to mitigate legionella. See the HVAC control points list and Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.
- L. Work in Existing Building:
 - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 - 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.
- M. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.
- N. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons will be sealed with plumbers' putty.
- O. Switchgear Drip Protection: Every effort will be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve will be provided in low point of casement pipe.
- P. Inaccessible Equipment:
 - 1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment will be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Owner.
 - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation will be provided to maintain continuity of operation of existing facilities.
- B. The Contractor will provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment will be properly supported, sloped to drain, operate without excessive stress, and will be

insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 will apply.

- C. Temporary facilities and piping will be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are prohibited in potable water systems. Necessary blind flanges and caps will be provided to seal open piping remaining in service.

3.3 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes will be drilled or burned in structural steel ONLY with the prior written approval of the COR.
- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above will not be permitted. Rusty products will be replaced.
- C. Hanger rods will be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work will be provided.
- D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.
- E. Overhead Supports:
 - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
 - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
 - 3. Tubing and capillary systems will be supported in channel troughs.
- F. Floor Supports:
 - 1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems will be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
 - 2. Bases and supports will not be located and installed until equipment mounted thereon has been approved. Bases will be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings will be reviewed for additional requirements. Bases will be neatly finished and smoothed, will have chamfered edges at the top, and will be suitable for painting.
 - 3. All equipment will be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts will be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
 - 4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.4 LUBRICATION

- A. All equipment and devices requiring lubrication will be lubricated prior to initial operation. All devices and equipment will be field checked for proper lubrication.
- B. All devices and equipment will be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application will be provided. All materials will be delivered to COR in unopened containers that are properly identified as to application.
- C. A separate grease gun with attachments for applicable fittings will be provided for each type of grease applied.
- D. All lubrication points will be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points will be extended to one side of the equipment.

3.5 PLUMBING SYSTEMS DEMOLITION

- A. Rigging access, other than indicated in the drawings, will be provided after approval for structural integrity by the EOR. Such access will be provided at no additional cost or time to the Owner. Where work is in an operating plant, approved protection from dust and debris will be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, cleanliness and safety will be maintained. The plant will be kept in an operating condition. Owner personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work will be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris will not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting will be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities will be available at all times. All work will be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VAMC, and the Contractor will follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.
- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work will be completely removed from Owner property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings will be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system will be maintained. Reference will also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- D. All valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells will remain Owner property and will be removed and delivered to COR and stored as directed. The Contractor will remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material will be removed from Owner property expeditiously and will not be allowed to accumulate. Coordinate with the COR and Infection Control.

3.6 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Owner, the plant facilities, equipment and systems will be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.
- B. In addition, the following special conditions apply:
 - 1. Cleaning will be thorough. Solvents, cleaning materials and methods recommended by the manufacturers will be used for the specific tasks. All rust will be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions will be repaired prior to applying prime and finish coats.
 - 2. The following Material and Equipment will NOT be painted:
 - a Motors, controllers, control switches, and safety switches.
 - b Control and interlock devices.
 - c Regulators.
 - d Pressure reducing valves.
 - e Control valves and thermostatic elements.
 - f Lubrication devices and grease fittings.
 - g Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h Valve stems and rotating shafts.
 - i Pressure gauges and thermometers.
 - j Glass.
 - k Name plates.
 - 3. Control and instrument panels will be cleaned and damaged surfaces repaired. Touch-up painting will be made with matching paint type and color obtained from manufacturer or computer matched.
 - 4. Pumps, motors, steel and cast-iron bases, and coupling guards will be cleaned, and will be touched-up with the same paint type and color as utilized by the pump manufacturer.
 - 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
- C. The final result will be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment will be repainted, if necessary, to achieve this. Lead based paints will not be used.

3.7 IDENTIFICATION SIGNS

- A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, will be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols will correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data will be placed on factory-built equipment.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.8 STARTUP AND TEMPORARY OPERATION

- A. Startup of equipment will be performed as described in the equipment specifications. Vibration within specified tolerance will be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.9 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, all required tests will be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.
- C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests will be requested in writing to EOR for approval.

END OF SECTION 220511

SECTION 22 07 11 PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for the following:
 - 1. Plumbing piping and equipment.
 - 2. Re-insulation of plumbing piping and equipment after asbestos abatement and or replacement of any part of existing insulation system (insulation, vapor retarder jacket, protective coverings/jacket) damaged during construction.
- B. Definitions:
 - 1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
 - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 - 3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
 - 4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
 - 5. Concealed: Piping above ceilings and in chases, //interstitial space, // and pipe spaces.
 - 6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, //interstitial spaces, // unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 7. FSK: Foil-scrim-Kraft facing.
 - 8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
 - 9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
 - 10. Thermal conductance: Heat flow rate through materials.
 - 11. Flat surface: Watts per square meter (BTU per hour per square foot).
 - 12. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
 - 13. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).

14. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
15. HWR: Hot water recirculating.
16. CW: Cold water.
17. SW: Soft water.
18. HW: Hot water.
19. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
SPEC WRITER NOTE:
Make material requirements in this section agree with applicable requirements in the related section below with regards to prohibited materials, recycled content, etc.
- C. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
B209-2014 Standard Specification for Aluminum and Aluminum-Alloy
Sheet and Plate

C411-2011 Standard Test Method for Hot-Surface Performance of High-
Temperature Thermal Insulation

C449-2007 (R2013) Standard Specification for Mineral Fiber Hydraulic-Setting
Thermal Insulating and Finishing Cement

C450-2008 (R2014) Standard Practice for Fabrication of Thermal Insulating Fitting
Covers for NPS Piping, and Vessel Lagging

Adjunct to C450.....Compilation of Tables that Provide Recommended Dimensions
for Prefab and Field Thermal Insulating Covers, etc.

C547-2015 Standard Specification for Mineral Fiber Pipe Insulation

- C553-2013 Standard Specification for Mineral Fiber Blanket Thermal
Insulation for Commercial and Industrial Applications
- C591-2013 Standard Specification for Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation
- C680-2014 Standard Practice for Estimate of the Heat Gain or Loss and the
Surface Temperatures of Insulated Flat, Cylindrical, and
Spherical Systems by Use of Computer Programs
- C612-2014 Standard Specification for Mineral Fiber Block and Board
Thermal Insulation
- C1126-2014 Standard Specification for Faced or Unfaced Rigid Cellular
Phenolic Thermal Insulation
- C1136-2012 Standard Specification for Flexible, Low Permeance Vapor
Retarders for Thermal Insulation
- C1710-2011 Standard Guide for Installation of Flexible Closed Cell
Preformed Insulation in Tube and Sheet Form
- D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven
and Treated) for Roofing and Waterproofing
- E84-2015a.....Standard Test Method for Surface Burning Characteristics of
Building Materials
- E2231-2015.....Standard Practice for Specimen Preparation and Mounting of
Pipe and Duct Insulation to Assess Surface Burning
Characteristics
- C. Federal Specifications (Fed. Spec.):
- L-P-535E-1979 Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and
Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- D. International Code Council, (ICC):
- IMC-2012.....International Mechanical Code
- E. National Fire Protection Association (NFPA):
- 90A-2015 Standard for the Installation of Air-Conditioning and Ventilating
Systems

- F. Underwriters Laboratories, Inc (UL):
723-2008 (R2013).....Standard for Test for Surface Burning Characteristics of
Building Materials

1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame
and Smoke Characteristics

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
- D. Shop Drawings:
1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
 - a Insulation materials: Specify each type used and state surface burning characteristics.
 - b Insulation facings and jackets: Each type used and state surface burning characteristics.
 - c Insulation accessory materials: Each type used.
 - d Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
 - e Make reference to applicable specification paragraph numbers for coordination.
 - f All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

1.5 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. Criteria:
1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:

4.3.3.1 Pipe and duct insulation and coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems shall have, in the form in which they are

used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.

4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).

4.3.11.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.11.2.6.8 Smoke detectors shall not be required to meet the provisions of Section 4.3.

2. Test methods: ASTM E84, UL 723, and ASTM E2231.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

1.6 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be // in electronic version on compact disc or DVD // inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

1.7 STORAGE AND HANDLING OF MATERIAL

- A. Store materials in clean and dry environment, pipe insulation jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m³ (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).
- B. ASTM C553 (Blanket, Flexible) Type I, // Class B-3, Density 16 kg/m³ (nominal 1 pcf), k = 0.045 (0.31) // Class B-5, Density 32 kg/m³ (nominal 2 pcf), k = 0.04 (0.27) // at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F).
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

- A. ASTM C534/C534M, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (199 degrees F). Under high humidity exposures for condensation control an external vapor retarder/barrier jacket is required. Consult ASTM C1710.

2.3 INSULATION FACINGS AND JACKETS

- A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.
- B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.
- D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping //exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations //conveying fluids below ambient temperature//. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor

permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

- E. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping //exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations //conveying fluids below ambient temperature//. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- F. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.
- H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.
- I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.4 PIPE COVERING PROTECTION SADDLES

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

2.5 ADHESIVE, MASTIC, CEMENT

- A. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- B. Other: Insulation manufacturers' published recommendations.

2.6 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.
- D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.
- E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

2.7 REINFORCEMENT AND FINISHES

- A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide

mitered pipe insulation of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

2.8 FIRESTOPPING MATERIAL

- A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.9 FLAME AND SMOKE

- A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer's Representative (COR) for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).
- D. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.
- F. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.
- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer coating (caution about coating's maximum temperature limit) or jacket material.

- H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- I. Plumbing work not to be insulated unless otherwise noted:
 - 1. Piping and valves of fire protection system.
 - 2. Chromium plated brass piping.
 - 3. Water piping in contact with earth.
 - 4. Distilled water piping.
- J. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.
- K. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- L. Firestop Pipe insulation:
 - 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
 - 2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - a Pipe risers through floors
 - b Pipe chase walls and floors
 - c Smoke partitions
 - d Fire partitions
 - e Hourly rated walls
- M. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (3/4 inch) thick insulation, for all pipe sizes 75 mm (3 inches) and smaller and 25 mm (1 inch) thick insulation for larger pipes. Provide metal jackets for all pipe insulations. Provide freeze protection for cold water make-up piping and equipment where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).
- N. Provide vapor barrier systems as follows:
 - 1. All piping exposed to outdoor weather.
 - 2. All interior piping conveying fluids, exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.), below ambient air temperature //in high humidity locations.
- O. Provide metal jackets over insulation as follows:
 - 1. All plumbing piping exposed to outdoor weather.
 - 2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets

except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.

3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

P. Provide PVC jackets over insulation as follows:

1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
 - b Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
 - c Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

B. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer. External vapor barrier jacketing may be required for expected or anticipated high humidity exposures. See ASTM C1710.
2. Pipe and tubing insulation:

- a Use proper size material. Do not stretch or strain insulation.
 - b To avoid undue compression of insulation, use supports as recommended by the elastomeric insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
 - c Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Bio-based materials shall be utilized when possible.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
 4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

3.3 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
Operating Temperature Range/Service	Insulation Material	Nominal Pipe Size Millimeters (Inches)			
		Less than 25 (1)	25 – 32 (1 – 1¼)	38 – 75 (1½ - 3)	100 (4) and Greater
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

4-15 degrees C (40-60 degrees F) (//Ice water piping//)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60 degrees F) (//Ice water piping//)	Polyiso-cyanurate Closed-Cell Rigid(Exterior Locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
(4-15 degrees C (40-60 degrees F) (//Ice water piping//)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60 degrees F) (//Ice water piping//)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

END OF SECTION 220711

SECTION 22 11 00 FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 07 84 00, FIRESTOPPING.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. Section 22 07 11, PLUMBING INSULATION.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 - A13.1-2007 (R2013).....Scheme for Identification of Piping Systems
 - B16.3-2011 Malleable Iron Threaded Fittings: Classes 150 and 300
 - B16.9-2012 Factory-Made Wrought Buttwelding Fittings
 - B16.11-2011 Forged Fittings, Socket-Welding and Threaded
 - B16.12-2009 (R2014) ...Cast Iron Threaded Drainage Fittings
 - B16.15-2013 Cast Copper Alloy Threaded Fittings: Classes 125 and 250
 - B16.18-2012 Cast Copper Alloy Solder Joint Pressure Fittings
 - B16.22-2013 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
 - B16.24-2011 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
 - ASME Boiler and Pressure Vessel Code -
 - BPVC Section IX-2015 Welding, Brazing, and Fusing Qualifications

- C. American Society of Sanitary Engineers (ASSE):
1010-2004 Performance Requirements for Water Hammer Arresters
- D. American Society for Testing and Materials (ASTM):
A47/A47M-1999 (R2014) Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2012 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A183-2014 Standard Specification for Carbon Steel Track Bolts and Nuts

A269/A269M-2014e1 ... Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A312/A312M-2015 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A403/A403M-2014 Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

A536-1984 (R2014) Standard Specification for Ductile Iron Castings

A733-2013 Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

B32-2008 (R2014) Standard Specification for Solder Metal

B43-2014 Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B61-2008 (R2013) Standard Specification for Steam or Valve Bronze Castings

B62-2009 Standard Specification for Composition Bronze or Ounce Metal Castings

B75/B75M-2011 Standard Specification for Seamless Copper Tube

B88-2014 Standard Specification for Seamless Copper Water Tube

B584-2014 Standard Specification for Copper Alloy Sand Castings for General Applications

B687-1999 (R2011) Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

- C919-2012 Standard Practice for Use of Sealants in Acoustical Applications
- D1785-2012 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic
Pipe, Schedules 40, 80, and 120
- D2000-2012 Standard Classification System for Rubber Products in
Automotive Applications
- D2564-2012 Standard Specification for Solvent Cements for Poly (Vinyl
Chloride) (PVC) Plastic Piping Systems
- D2657-2007 Standard Practice for Heat Fusion Joining of Polyolefin Pipe and
Fittings
- D2855-1996 (R2010) Standard Practice for Making Solvent-Cemented Joints with
Poly (Vinyl Chloride) (PVC) Pipe and Fittings
- D4101-2014 Standard Specification for Polypropylene Injection and
Extrusion Materials
- E1120-2008 Standard Specification for Liquid Chlorine
- E1229-2008 Standard Specification for Calcium Hypochlorite
- F2389-2010 Standard Specification for Pressure-rated Polypropylene (PP)
Piping Systems
- F2620-2013 Standard Practice for Heat Fusion Joining of Polyethylene Pipe
and Fittings
- F2769-2014 Standard Specification for Polyethylene of Raised Temperature
(PE-RT) Plastic Hot and Cold-Water Tubing and
Distribution Systems
- E. American Water Works Association (AWWA):
- C110-2012 Ductile-Iron and Gray-Iron Fittings
- C151-2009 Ductile Iron Pipe, Centrifugally Cast
- C153-2011 Ductile-Iron Compact Fittings
- C203-2008 Coal-Tar Protective Coatings and Linings for Steel Water
Pipelines - Enamel and Tape - Hot Applied

- C213-2007 Fusion-Bonded Epoxy Coating for the Interior and Exterior of
Steel Water Pipelines
- C651-2014 Disinfecting Water Mains
- F. American Welding Society (AWS):
A5.8M/A5.8-2011-AMD1 Specification for Filler Metals for Brazing and Braze
Welding
- G. International Code Council (ICC):
IPC-2012 International Plumbing Code
- H. Manufacturers Specification Society (MSS):
SP-58-2009 Pipe Hangers and Supports - Materials, Design, Manufacture,
Selection, Application, and Installation
- SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends for General
Service
- SP-110-2010 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved
and Flared Ends
- I. NSF International (NSF):
14-2015 Plastics Piping System Components and Related Materials
- 61-2014a Drinking Water System Components – Health Effects
- 372-2011 Drinking Water System Components – Lead Content
- J. Plumbing and Drainage Institute (PDI):
PDI-WH 201-2010..... Water Hammer Arrestors

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 11 00, FACILITY WATER DISTRIBUTIONS”, with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. All items listed in Part 2 - Products.

- D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

- A. All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

1.6 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version //____// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- C. Certification documentation shall be provided to eOR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead are prohibited in any potable water system intended for human consumption and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61, Section 9.
- B. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

2.2 ABOVE GROUND (INTERIOR) WATER PIPING

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn.
- B. Fittings for Copper Tube:
 - 1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
 - 2. Mechanical press-connect fittings for copper pipe and tube **are prohibited**.

3. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.
- C. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.
- D. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.
- E. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

2.3 TRAP PRIMER WATER PIPING

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ASME B16.18 Solder joints.
- C. Solder: ASTM B32 alloy type Sb5. Provide non-corrosive flux.

2.4 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- C. Body: Less than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and greater, cast iron or semi-steel.

2.5 DIELECTRIC FITTINGS

- A. Provide dielectric nipples, couplings, or unions between pipe of dissimilar metals.

2.6 STERILIZATION CHEMICALS

- A. Hypochlorite: ASTM E1229.
- B. Liquid Chlorine: ASTM E1120.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the International Plumbing Code and the following:
 1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.
 3. All pipe runs shall be laid out to avoid interference with other work/trades.
 4. Install union and shut-off valve on pressure piping at connections to equipment.
 5. Pipe Hangers, Supports and Accessories:

- a All piping shall be supported per the IPC, H-18-8 Seismic Design Handbook, MSS SP-58, and SMACNA as required.
 - b Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
 - c Floor, Wall and Ceiling Plates, Supports, Hangers:
 - 1) Solid or split un-plated cast iron.
 - 2) All plates shall be provided with set screws.
 - 3) Pipe Hangers: Height adjustable clevis type.
 - 4) Adjustable Floor Rests and Base Flanges: Steel.
 - 5) Concrete Inserts: "Universal" or continuous slotted type.
 - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - 7) Pipe Hangers and Riser Clamps: Malleable iron or carbon steel. Pipe Hangers and riser clamps shall have a copper finish when supporting bare copper pipe or tubing.
 - 8) Rollers: Cast iron.
 - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
 - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180-degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield thickness and length shall be engineered and sized for distribution of loads to preclude crushing of insulation without breaking the vapor barrier. The shield shall be sized for the insulation and have flared edges to protect vapor-retardant jacket facing. To prevent the shield from sliding out of the clevis hanger during pipe movement, center-ribbed shields shall be used.
 - 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
 - 12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints. Restraint calculations shall be based on the criteria from the manufacturer regarding their restraint design.
6. Penetrations:
- a Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the

spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.

b Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

c Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.

B. Domestic Water piping shall conform to the following:

1. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot and cold water circulating lines with no traps.
2. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

- A. General: Test system either in its entirety or in sections.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 1035 kPa (150 psig) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested. Pressure gauge shall have 1 psig increments.
- C. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.
- D. The test pressure shall hold for the minimum time duration required by the applicable plumbing code or authority having jurisdiction.

3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- B. Use liquid chlorine or hypochlorite for sterilization.

END OF SECTION 221100

SECTION 22 13 00 FACILITY SANITARY AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.
- B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
- D. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
- E. Section 07 92 00, JOINT SEALANTS: Sealant products.
- F. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- H. Section 22 07 11, PLUMBING INSULATION.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
- B. American Society of Mechanical Engineers (ASME):
 - A13.1-2007 Identification of Piping Systems
 - A112.36.2M-1991.....Cleanouts
 - B1.20.1-2013 Pipe Threads, General Purpose (Inch)
 - B16.15-2018 Cast Copper Alloy Threaded Fittings, Classes 125 and 250
 - B16.18-2018 Cast Copper Alloy Solder Joint Pressure Fittings
 - B16.21-2016 Nonmetallic Flat Gaskets for Pipe Flanges
 - B16.22-2018 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
 - B16.23-2016 Cast Copper Alloy Solder Joint Drainage Fittings: DWV

- B16.24-2016 Cast Copper Alloy Pipe Flanges and Flanged Fittings, and
Valves: Classes 150, 300, 600, 900, 1500, and 2500
- B16.29-2017 Wrought Copper and Wrought Copper Alloy Solder-Joint
Drainage Fittings: DWV
- B18.2.1-2012 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex,
Heavy Hex, Hex Flange, Lobed Head, and Lag Screws
(Inch Series)
- C. American Society of Sanitary Engineers (ASSE):
- 1018-2001 Performance Requirements for Trap Seal Primer Valves –
Potable Water Supplied
- 1044-2015 Performance Requirements for Trap Seal Primer Devices –
Drainage Types and Electronic Design Types
- 1079-2012 Performance Requirements for Dielectric Pipe Unions
- D. American Society for Testing and Materials (ASTM):
- A53/A53M-2018..... Standard Specification for Pipe, Steel, Black And Hot-Dipped,
Zinc-coated, Welded and Seamless
- A74-2017 Standard Specification for Cast Iron Soil Pipe and Fittings
- A888-2018a Standard Specification for Hubless Cast Iron Soil Pipe and
Fittings for Sanitary and Storm Drain, Waste, and Vent
Piping Applications
- B32-2008(R2014)..... Standard Specification for Solder Metal
- B88-2016 Standard Specification for Seamless Copper Water Tube
- B306-2013 Standard Specification for Copper Drainage Tube (DWV)
- B687-1999(R2016) Standard Specification for Brass, Copper, and Chromium-Plated
Pipe Nipples
- B813-2016 Standard Specification for Liquid and Paste Fluxes for Soldering
of Copper and Copper Alloy Tube
- B828-2016 Standard Practice for Making Capillary Joints by Soldering of
Copper and Copper Alloy Tube and Fittings

- C564-2014 Standard Specification for Rubber Gaskets for Cast Iron Soil
Pipe and Fittings
- D2321-2018 Standard Practice for Underground Installation of Thermoplastic
Pipe for Sewers and Other Gravity-Flow Applications
- F477-2014 Standard Specification for Elastomeric Seals (Gaskets) for
Joining Plastic Pipe
- F1545-2015e1 Standard Specification for Plastic-Lined Ferrous Metal Pipe,
Fittings, and Flanges
- E. Cast Iron Soil Pipe Institute (CISPI):
- 2006 Cast Iron Soil Pipe and Fittings Handbook
- 301-2012 Standard Specification for Hubless Cast Iron Soil Pipe and
Fittings for Sanitary and Storm Drain, Waste, and Vent
Piping Applications
- 310-2012 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
- F. Copper Development Association, Inc. (CDA):
- A4015-14/19 Copper Tube Handbook
- G. International Code Council (ICC):
- IPC-2018 International Plumbing Code
- H. Manufacturers Standardization Society (MSS):
- SP-123-2018 Non-Ferrous Threaded and Solder-Joint Unions for Use with
Copper Water Tube
- I. National Fire Protection Association (NFPA):
- 70-2020 National Electrical Code (NEC)
- J. Underwriters' Laboratories, Inc. (UL):
- 508-99 (R2013) Standard For Industrial Control Equipment

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with
Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 13 00, FACILITY SANITARY AND VENT PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Piping.
 - 2. Floor Drains.
 - 3. Cleanouts.
 - 4. Trap Seal Protection.
 - 5. Penetration Sleeves.
 - 6. Pipe Fittings.
 - 7. Traps.
 - 8. Exposed Piping and Fittings.
- D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 AS-BUILT DOCUMENTATION

- A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

- A. Cast iron waste, drain, and vent pipe and fittings.
 - 1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
 - a Pipe buried in or in contact with earth.
 - b Sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
 - c Interior waste and vent piping above grade.
 - 2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).

3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.
4. Cast iron pipe and fittings shall be made from a minimum of 95 percent post-consumer recycled material.
5. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

2.2 SPECIALTY PIPE FITTINGS

- A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:
 1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 861 kPa (125 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F1545 with a pressure rating of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.3 CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated in the contract document and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

SPEC WRITER NOTE: Do not modify any of the Floor Drain Types listed below. Floor drain types may be removed if they are not used in the project. If the need arises, you may add another Floor Drain Type to the bottom of the list and number it alphabetically. E.g. Type Z (FD-Z). See Veterans Affairs Plumbing Design Manual for specific application of floor drain types.

2.4 FLOOR DRAINS

- A. General Data: floor drain shall comply with ASME A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening shall not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, a $\frac{1}{4}$ kg (16-ounce) soft copper $\frac{1}{8}$ to 1.8 Kg (2.5 to 4 lbs.) flashing membrane, 600 mm (24 inches) square or another approved waterproof membrane shall be provided.
- B. Type S (FD-S) floor sink shall comply with ASME A112.6.3. The type S floor sink shall be chemical resistant porcelain enamel coated cast iron and shall be 300 mm (12 inches) square, and 200 mm (8 inches deep). The interior surface shall be polished. The double drainage flange shall be provided with weep holes, internal dome strainer, and heavy duty non-tilting loose set grate. A clamping device shall be provided.

2.5 TRAPS

- A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as the piping they are connected to. Slip joints are prohibited on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.6 PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

- A. Trap Primer (TP-1): The trap seal primer system shall be electronic type conforming to ASSE 1044.
1. The controller shall have a 24 hour programmable timer, solid state, 6 outlet zones, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, manual switch for 120VAC power, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic.
 2. The cabinet shall be surface mounting with a stainless steel cover.
 3. The solenoid valve shall have a brass body, suitable for potable water service, normally closed, 861 kPa (125 psig) rated, 24VAC.
 4. The control wiring shall be copper in accordance with the National Electric Code (NFPA 70), Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.
 5. The vacuum breaker shall conform to ASSE 1001.

2.7 PENETRATION SLEEVES

- A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that shall extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that shall extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.
- B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings where possible.
- F. The piping shall be installed to permit valve servicing or operation.
- G. The piping shall be installed free of sags and bends.
- H. Seismic restraint shall be installed where required by code.
- I. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter

bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow greater than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- J. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- K. If an installation is unsatisfactory to the EOR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 JOINT CONSTRUCTION

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.
 - 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

3.3 SPECIALTY PIPE FITTINGS

- A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

- A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.
- B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be painted according to Section 09 91 00, PAINTING. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
 2. 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
 3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.
 4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.
 5. 250 mm or DN250 to 300 mm or DN300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 23 mm (7/8 inch) rod.
- E. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).
- F. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
 2. All plates shall be provided with set screws.
 3. Height adjustable clevis type pipe hangers.
 4. Adjustable floor rests and base flanges shall be steel.
 5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 6. Riser clamps shall be malleable iron or steel.
 7. Rollers shall be cast iron.
 8. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- G. Miscellaneous materials shall be provided as specified, required, directed or as noted in the contract documents for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- H. Penetrations:
1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
 2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 TESTS

- A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.
- B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

END OF SECTION 221300

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to Divisions 01 of these specifications, which govern work under Division 23. Refer to other sections in these specifications for additional related requirements.

1.2 SCOPE OF REQUIREMENTS

- A. The work covered by Division 23 of the specifications (HVAC/Mechanical) shall include but not limited to furnishing all materials and supplying all labor, equipment, and services to install the complete mechanical systems as shown on the accompanying drawings and specified herein.
- B. Work done under Division 23 of the specifications shall comply with the requirements specified herein.

1.3 CODES, PERMITS AND FEES

- A. Division 23 work shall be in accordance with the following as adopted by the governing agencies including amendments:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Applicable State and Local Codes and Ordinances
 - 3. National Electric Code
 - 4. International Building Code
 - 5. International Fire Code
 - 6. International Mechanical Code
 - 7. Idaho State Plumbing Code
 - 8. International Energy Code
 - 9. International Fuel Gas Code
- B. Permits and inspections required for the Division 23 work on this project shall be obtained as part of the Division 23 scope of work, and the cost for these permits and inspections shall be included in the Division 23 bid. All inspection certificates shall be delivered to the Owner's Representative prior to final acceptance of the work in accordance with the requirements of these specifications.
- C. All costs levied by utility companies and/or governing agencies shall be included in the Division 23 scope of work and shall be included in the Division 23 bid.
- D. Work shall comply with all regulations associated with all applicable utilities.

1.4 INTENT AND INTERPRETATIONS

- A. It is the intent of these plans and specifications to result in a complete and working Division 23 installation in complete accordance with all applicable codes and ordinances.
- B. The drawings and these specifications are intended to supplement each other. Any details contained in either the drawings or these specifications shall be included as if contained in both.

- C. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

1.5 DEFINITIONS

- A. The term “Acceptance”, when used in Division 23, shall be defined as the Owner’s assumption of ownership for part or all of the Division 23 system. Acceptance of part or all of the Division 23 system, when granted prior to completion of Division 23 work and/or correction of deficiencies, shall not relieve Division 23 of any responsibility for completion of this work and/or correction of these deficiencies. This includes any and all issues identified by the Commissioning Authority and/or design team.
- B. The term “Date of Acceptance”, when used in Division 23, shall be the official date when Acceptance, as defined, occurs. The Date of Acceptance shall be assumed to coincide with granting of Substantial Completion unless noted otherwise by the Owner’s Representative. Deviation of the Date of Acceptance from Substantial Completion can assume to have occurred only when written documentation is provided by the Owner’s Representative specifically indicating this separation and identifying an alternative designation for the Date of Acceptance.
- C. The terms “The Contractor” or “This Contractor”, when used, shall be defined as the Contractor responsible for Division 23 work.
- D. The term “Owner’s Representative”, when used, shall refer to the Engineer or his designated representative in accordance with Division 00 and 01.
- E. The term “Provide” shall mean furnish and install.
- F. The term “HVAC” or “Mechanical”, when used, to distinguish a particular scope of work or portion of the documents, shall mean the Division 23 scope of work and Division 23 documents (drawings and specifications) respectively.

1.6 DRAWINGS

- A. HVAC and Mechanical drawings show general arrangement of piping, ductwork, equipment, etc. Drawings shall be followed as closely as actual building construction and work of other trades will permit.
- B. General 01 specifications shall be considered part of this work insofar as they furnish information relating to design and construction of the building. These documents take precedence over Division 23 drawings and specifications if any dimensional discrepancies exist.
- C. Drawings are diagrammatic only. Consequently, all required pipe offsets are not indicated on the drawings. Offsets as required to meet the design intent of the drawings shall be provided.

1.7 GUARANTEE (REFER TO DIVISIONS 00 AND 01)

- A. The Division 23 equipment, materials, and installation shall be guaranteed for a period of one (1) year unless an individual item or specification is otherwise noted as longer. All defects in Division 23 work and/or equipment furnished that develop at any time during the two-year guarantee period shall be corrected at no cost to the owner, including an expense for cutting, patching, and repairing made necessary by corrections of unsatisfactory work and/or damage resulting from incorrect equipment operation.

- B. The guarantee period shall begin upon the Date of Acceptance. When Acceptance is granted for portions of the Division 23 system at different times, the guarantee for each portion of the Division 23 system shall begin upon Acceptance of that portion of the Division 23 system.
- C. Permission to use the permanent Mechanical system for temporary cooling during construction doesn't constitute acceptance. All product and system warranties shall be extended at no cost to the Owner as required to maintain this two (2) year requirement from the Date of Acceptance if such permission is given.
 - 1. Exception: Use of part or all of the Division 23 system prior to the Date of Acceptance, when initiated by the Owner, shall constitute Acceptance of the specific piece of equipment and/or portion of the system only when acknowledgement of Acceptance is noted in written authorization from the Owner as required in these specifications.
- D. Equipment warranties in addition to this guarantee shall be provided in accordance with the table at the end of this section.

1.8 STRAINERS AND SYSTEM CLEANING

- A. Construction strainers and any other equipment used during flushing and charging of the system shall be cleaned and/or replaced with final strainers provided with the equipment.

1.9 COST BREAKDOWN

- A. Refer to Divisions 00 and 01 for supplemental requirements
- B. A breakdown of the HVAC construction cost shall be furnished to the Owner's Representative within 30 days of Notice to Proceed, with separate costs for each of the items listed in the cost breakdown.

1.10 PAYMENT REQUESTS

- A. Refer to section 012900 – "PAYMENT PROCEDURES" for supplemental requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS – STANDARDS AND CODES

- A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated "New" equipment is not acceptable. Each item of equipment and material shall conform to the latest Standard Specifications of the American Society for Testing Materials and shall conform to any applicable standards of the United States Department of Commerce.
- B. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to the Owner.
- C. Motor efficiencies shall meet or exceed the requirements of the applicable energy code.
- D. All electrically driven or connected equipment shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC.
- E. Equipment shall be UL listed as an assembly where listing/labeling program is available for that type of equipment.

- F. All control panels shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC and applicable local electrical codes.
- G. All pressure vessels and relief valves shall be furnished in accordance with applicable State Boiler and Unfired Pressure Vessel Code where required by Code authorities or State Law.

2.2 EQUIPMENT/MATERIAL SUBSTITUTIONS

- A. Throughout these specifications and drawings, various materials, equipment, apparatus, etc., are specified or scheduled by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of design and the bid.
- B. Substitutions will not be permitted without written approval. (Refer to Division 00 and 01.)
- C. Where two or more manufacture designations are listed in these specifications, choice will be optional with the contractor except that where more than one manufacturer is listed an only one manufacturer's catalog number is specified or only one manufacturer scheduled on the drawings (basis of design), that standard of quality, dimensional characteristics, capacities, and construction shall be maintained by materials or equipment supplied by the other manufacturer(s).
- D. Substituted equipment with efficiencies less than 98% of the basis of design efficiency shall not be considered equal to the basis of design.
- E. If the Division 23 Contractor uses manufacturers other than the basis of design, the Contractor shall be responsible for:
 - 1. Insuring the substituted item will fit the available space while allowing proper maintenance access.
 - 2. Any changes required by other Contractors caused by the substituted equipment
 - 3. Changes to the electrical requirements: See "Equipment Substitutions – Electrical Characteristics" below
 - 4. Changes in structural design due to weight differences.
- F. In the event other than specified equipment is used and will not fit job site conditions, this Contractor shall assume responsibility for replacement with items indicated as the basis of design.

2.3 EQUIPMENT SUBSTITUTIONS – ELECTRICAL CHARACTERISTICS

- A. Products furnished other than the basis of design shall have similar electrical characteristics as the scheduled or specified equipment. The Contractor shall be responsible for any electrical changes caused by products not in accordance with this requirement.

2.4 SUBMITTALS

- A. Refer to section 013300 – "SUBMITTAL PROCEDURES" for supplemental requirements.
- B. Shop drawings, catalog information and material schedules shall be submitted for approval on all specified materials and equipment prior to ordering.

- C. Provide specific wiring diagrams for all equipment requiring electrical or control wiring. Upon approval, copies of these diagrams shall be forwarded to pertinent contractors.
- D. Furnish complete shop drawing/catalog data for equipment and materials to be used in the work for review. Allow sufficient time for developing shop drawings, processing and review time so that the installation will not be delayed.
- E. Shop drawings shall be reviewed, approved and stamped by the Contractor prior to submitting to the Owner's Representative for approval. Submittals without such approval will be returned without review.
- F. Where choices of options and accessories are available or specified, provide written description of what is to be furnished. If necessary, list page numbers where submitted items are described.
- G. State sizes, capacities, brand names, motor horsepower, electrical characteristics, accessories, materials, gauges, dimensions, and other pertinent information.
- H. If material or equipment is not as specified or submittal is not complete, it will be rejected. Only complete submittal including all applicable specifications sections will be reviewed.
- I. Catalog data or shop drawings for equipment which are noted as being reviewed shall not supersede Contract Documents.
- J. Review comments shall not relieve the Contractor from responsibility for deviations from Contract Documents unless attention has been called to such deviations in writing at time of submission, nor shall they relieve this Contractor from responsibility for errors in items submitted.
- K. Check work described by catalog data with Contract Documents for deviations and errors.
- L. Shop drawings and submittal information shall be provided for all required Division 23 equipment separated by specification section for each submittal.
- M. Submittal Format:
 - 1. Electronic submittals shall be provided with accordance with all of the following conditions. Electronic submittals which do not comply with all of these conditions will be rejected without review.
 - a Electronic submittals shall be submitted in the current version of Adobe Portable Document Format (PDF)
 - b Submittals shall be original PDF's of the document and shall not be created using scanned copies of paper documents
 - c PDF documents shall be searchable.
 - d PDF documents shall be unlocked
 - e Electronic submittals shall be separated by specification section and identified as such. Submittals which combine multiple sections into a single document will not be reviewed and will be returned for corrections.
 - f Electronic submittals shall include a table of contents and each applicable section shall be bookmarked for easy access.
 - g Electronic submittals shall be clearly marked in RED using boxes and arrows and other appropriate markings to indicate specific product information, option selections, accessories, etc.

- N. Each product shall be keyed to the paragraph number in the specifications.
- O. Operation and maintenance data for individual equipment shall also be provided subsequent to approval of equipment submittals in a separate binder meeting the same requirements as the submittal binder. Refer to Part 3 of this specification for supplemental requirements.
- P. All submittals and re-submittals as required shall be provided with a cover page incorporating a table similar to that provided at the end of this section. The appropriate box(es) shall be on each line item for all submittals.

PART 3 - EXECUTION

3.1 LOCATIONS

- A. Coordination of Division 23 equipment and systems to the available space, with other trades and to the access routes through the construction shall be Contractor's responsibility.
- B. Drawings are diagrammatic. Make offsets, transitions, and changes in direction of pipes as required to maintain proper head room and pitch of sloping lines and avoid structural, electrical, pipe and duct interferences whether or not indicated on Drawings. Furnish fittings, etc., as required to make these offsets, transitions and changes in direction at no additional cost to the Owner.
- C. Pipe and duct routing shall be coordinated and verified with all trades prior to fabrication and installation. Additional project costs resulting from failure to do so shall be the contractor's responsibility.
- D. Determine exact route and location of each pipe and duct and coordinate and obtain approval for changes from the layout indicated on the drawings with the Owner's Representative prior to fabrication.
- E. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Verify the physical dimensions of each item of Division 23 equipment to fit the available space and promptly notify the Owner's Representative prior to roughing-in if conflicts appear.
- F. All piping, wiring, equipment, ductwork, tubing, etc., shall be concealed within building construction unless otherwise noted, or in Division 23 rooms.
- G. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, trap primers, starters, motors, control components, and to clear openings of doors and access panels.
- H. Existing Utilities and Piping
 - 1. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10 foot radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Owner's Representative for a decision before proceeding or may proceed at his own expense.
 - 2. Connection points to existing work shall be located and verified prior to starting new work.

3. Prior to commencing any excavation or ditching activity, the Contractor shall verify the exact location and inverts of all existing utilities and connection points in the area of his proposed excavation. Notify the Owner's Representative for further direction if actual inverts will not allow the proper installation of new work.
4. The Contractor shall be responsible for damages which might be caused by his failure to exactly locate and preserve underground utilities.

3.2 SCHEDULING

- A. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner's Representative. Should conditions arise where certain changes would be advisable, secure approval from Owner's Representative for those changes before proceeding with work.
- B. The contractor shall coordinate with the work of various trades when installing interrelated work. Before installation of Division 23 items, proper provisions shall be made to avoid interferences. Changes required in work specified in Division 23 caused by neglect to do so shall be made at no cost to Owner.
- C. Supports and inserts in concrete required for Division 23 supports shall be furnished and installed unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 23. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

3.3 CUTTING AND PATCHING

- A. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 23 shall be the responsibility of the Division 23 Contractor. All cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.
- B. Walls, floors, ceilings and roof shall be patched and repaired with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner's Representative. Roof patching and final sealing must be performed by the roofing contractor holding the warranty.
- C. All cutting and patching made necessary to repair defective equipment, defective workmanship or be neglect of this Contractor to properly anticipate his requirements shall be included in Division 23.
- D. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative's written approval.

- E. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under Division 23 is responsibility of Division 23. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

3.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Refer to Division 01 for supplemental requirements.
- B. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
- C. promptly notify Owner's Representative in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain written instructions from Owner's Representative before proceeding with work. The Contractor shall bear expenses arising from correcting deficiencies of work that do not comply with manufacturer's directions or such written instructions from Owner's Representative.
- D. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.
- E. Notify Owner of equipment delivery dates twenty-four (24) hours in advance of delivery.
- F. The Contractor shall be responsible for protection of equipment furnished in Division 23 from vandalism and weather during all phases of construction. Damaged equipment shall be restored to like new condition or replaced at the Contractor's expense.
- G. Ductwork shall be stored on pallets off of grade. Internally lined ductwork and air handling equipment shall be kept dry. Internal insulation that has been allowed to become wet will be rejected. Air handling equipment that has been allowed to become wet may be rejected.
- H. Any factory painted equipment scratched or marred during shipment or construction shall be restored to original "new" condition. This includes complete repainting if necessary to provide exact paint match.

3.5 VISITING THE PROJECT SITE

- A. The premises shall be examined and conditions shall be understood which may affect performance of work of Division 23 before submitting proposals for this work.
- B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions. Refer to Division 01 for supplemental requirements.

3.6 COMMISSIONING SUPPORT

- A. The equipment and systems referenced in the Related Work section are to be commissioned per Division 1 and Division 23 commissioning specifications. The contractor has specific responsibilities for scheduling, coordination, startup, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.
- B. Include allowance in the bid to support commissioning. Allowance shall be a separate line item on the schedule of values.
- C. Include time for commissioning activities on the construction schedule to complete commissioning prior to substantial completion with the exception of seasonal testing which

the commissioning agent determines should coincide with peak heating and cooling weather conditions.

- D. Related Work: All Sections in Division 23. The premises shall be examined and conditions shall be understood which may affect performance of work of Division 23 before submitting proposals for this work.

3.7 CONSTRUCTION WASTE MANAGEMENT

- A. As part of the sustainable construction process, construction waste may be salvaged or re-used for purposes other than this project.

3.8 PROJECT CLOSEOUT/OPERATION AND MAINTENANCE MANUAL

- A. Electronic submittals shall be provided with accordance with all of the following conditions. Electronic submittals which do not comply with all of these conditions will be rejected without review.
1. Electronic submittals shall be submitted in the current version of Adobe Portable Document Format (PDF)
 2. Submittals shall be original PDF's of the document and shall not be created using scanned copies of paper documents.
 3. PDF documents shall be searchable.
 4. PDF documents shall be unlocked
 5. Electronic submittals shall be separated by specification section and identified as such. Submittals which combine multiple sections into a single document will be rejected.
 6. Electronic submittals shall include a table of contents and each applicable section shall be bookmarked for easy access.
 7. Electronic submittals shall be clearly marked in RED using boxes and arrows and other appropriate markings to indicate specific product information, option selections, accessories, etc.
 8. Each product shall be keyed to the paragraph number in the specifications.
- B. Cover page shall include:
1. Job title and DPW Project Number.
 2. Date
 3. Engineer
 4. Contractor
 5. Construction Division
- C. Work shall be done in a print shop or bindery.
- D. Provide a master index at the beginning of the manual showing items included. Use plastic tab indexes for the sections and sub-sections of the manual.
- E. Manual shall be organized into the following five sections:
1. Contacts: This shall consist of name, address, and phone number of the following parties: Mechanical Engineer, Electrical Engineer, General Contractor, HVAC Contractor, Piping Contractor, Sheet Metal Contractor, Temperature Controls Contractor, Sprinkler Contractor, Electrical Contractor and major equipment suppliers.

2. Equipment
 - a Begin the Equipment section with a separate sub-section containing a list of the Division 23 equipment indicating:
 - 1) Equipment name and designation as it appears on the equipment schedule
 - 2) Area served
 - 3) Manufacturer
 - 4) Model
 - 5) Serial number
 - 6) Name plate data
 - b The remaining sub-sections shall include, at a minimum, the following for each item of Division 23 equipment. This material shall be organized in a separate tabbed sub-section for each section of the specifications. Within each sub-section, provide separate tabs for each item of equipment, referencing the equipment schedule designation. Provide the following information as applicable:
 - 1) Performance curves or tables showing the specified operating points and the operating points after final testing and balancing
 - 2) Manufacturer's maintenance instructions: Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, maintenance and lubrication instructions, troubleshooting guides, and overhaul specifications for major equipment.
 - 3) Step-by-step procedure to follow in putting each piece of Division 23 equipment into operation
 - 4) Wiring diagram for particular equipment item
 - 5) Refer to individual specification sections for additional information required to be incorporated into the Operation and Maintenance Manual.
3. Maintenance Schedule and Spare Parts
 - a This shall include two sub-sections:
 - 1) The first sub-section shall consist of a preventative maintenance schedule summary table (or list). The table shall be organized by specification section and include:
 - a) Equipment name and designation as it appears on the equipment schedule
 - b) Equipment location
 - c) Type and frequency of preventative maintenance requirements (including lubrication)
 - d) The second sub-section shall consist of a list of spare parts furnished under this contract. The list shall be organized by specification section and include (similar to that included at the end of this section):
 - e) Equipment name and designation as it appears on the equipment schedule
 - f) Spare part furnished
 - g) Verification by an Owner's Representative that the part(s) have been provided
4. Warranties and Certifications
 - a Shall include:
 - 1) Test and balance reports
 - 2) Test records of piping, ductwork, etc
 - 3) Signed checklist of instruction period
 - 4) Copies of specific product warranties
 - 5) Copies of certified factory start-up reports
 - 6) Valve tag identification schedules

- 7) Copy of manual describing specific maintenance services that will be furnished under this contract
- F. Prepare two (2) printed copies in three ring binders of approved manuals for use during the instruction period.
- G. Following instruction period, turn over both printed copies and electronic files to the Owner's Representative and the Owner.
- H. Manuals may be compiled in multiple volumes if necessary for ease of use.

3.9 PROJECT CLOSEOUT/CERTIFIED FACTORY STARTUP

- A. Refer to individual sections of these Specifications for specific requirements of certified factory start-up.
- B. Start-up shall be performed by a certified factory representative. Prior to start-up, certification of factory representative shall be forwarded to the Engineer for review.
- C. Start-up shall be scheduled with the owner to allow witnessing of start-up procedures by maintenance personnel. Operation and maintenance training for equipment requiring certified factory start-up shall be conducted at the time of start-up with the certified factory representative present.
- D. Certified factory start-up is required for the following equipment:
 1. Packaged rooftop units
 2. DX Split Systems

3.10 PROJECT CLOSEOUT/OPERATION AND MAINTENANCE TRAINING

- A. General
 1. Up to two (2) training sessions shall be scheduled. The first shall occur after final inspection and prior to substantial completion. The second shall occur prior to the end of the first year of operation after acceptance. Training sessions shall be scheduled with the owner a minimum of two (2) weeks in advance.
 2. Instruct the Owner's representative(s) in operation and maintenance of Division 23 systems utilizing Operation and Maintenance Manual.
 3. Individuals present shall include the Division 23 contractors, subcontractors and equipment factory representatives as appropriate. Certified factory representatives shall be present for all equipment requiring certified factory start-up.
 4. The contractor's representative performing the operation and maintenance training shall locate in the building each piece of equipment included in the O&M manuals, and shall instruct to the satisfaction of the owner's representative required operation and maintenance procedures as outlined in the O&M manuals.
 5. Provide a digital video of the training sessions conducted and furnish copies of the video to the Owner. Digital videos shall be of sufficient quality to allow training of future employees or refresher training of personnel. Use DVD format unless directed otherwise by the owner.

6. Training shall occur after final inspection and prior to acceptance by owner. It shall be scheduled with the owner, and shall occur in one consolidated session for all Division 23 equipment.

3.11 PROJECT CLOSEOUT/SPARE PARTS/MAINTENANCE MATERIALS

- A. Refer to individual specification sections for specific requirements of spare parts to be furnished under this contract.
- B. Turn spare parts and materials over to Owner.

3.12 96 HOUR RUN TEST

- A. The 96-hour test run shall be made when all field equipment is installed and the system is calibrated and running, and when all other building systems (including drywall, windows, doors, etc.) are complete. This period is intended to demonstrate the operation of the complete building.
- B. The 96-hour run test shall include performance of all associated software and hardware operations called for in these specifications. The test shall be for a duration of 96 continuous hours with no Contractor maintenance required. The pre-balance conference shall not be scheduled until this test has been completed satisfactorily (i.e. run without errors or alarms for a continuous 96-hour period). Notify owner's representative prior to beginning the 96-hour run test.

3.13 PROJECT CLOSEOUT/PRE-BALANCE REQUIREMENTS

- A. Refer to section 23 05 93.

3.14 PROJECT CLOSEOUT/COMMISSIONING REQUIREMENTS

- A. Refer to section 23 08 00

3.15 PROJECT CLOSEOUT/FINAL CLEANING

- A. Clean up all equipment, materials, cartons and other debris that is a direct result of the installation of equipment under this contract.
- B. Clean exposed piping, ductwork and equipment. Repair damaged finishes and leave everything in working order.

3.16 PROJECT CLOSEOUT/WARRANTIES

- A. Provide specific equipment/material **warranties that extend beyond 2-year project warranty period.**
 1. Refer to individual specifications sections for required extended warranties.
 2. Incorporate extended warranties into O&M Manual in warranties section.

3.17 PROJECT CLOSEOUT/RECORD DRAWINGS

- A. Provide in accordance with Division 01 and the requirements of this section.
- B. Record differences between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings to be furnished by Owner's Representative. Return these prints to Owner's Representative at completion of Project.

Notations made on drawings shall be neat and legible. These drawings shall not be used for any other purposes.

3.18 PROJECT CLOSEOUT/PUNCH LIST REQUIREMENTS

- A. The Contractor shall notify the Owner's Representative in writing when the project is ready for punch lists. The following items must be complete before punch list will be performed, and must be provided with written verification:
 - 1. Systems are complete and functional, including temperature controls.
 - 2. Testing and balancing is complete, and test and balance reports have been submitted for review.
 - 3. Operation and Maintenance Manuals are complete, and have been submitted for review.
- B. After punch lists are complete, written notice must be forwarded to the Owner's Representative requesting final checkout. Any additional trips beyond the final checkout required due to incomplete items on previous punch lists will be billed to the Contractor at normal rate plus travel expenses.
- C. At the time of initial and final observation, the project foreman shall accompany the observation party and shall remove access panels and perform other duties, as required, to allow complete observation of the entire Division 23 system-wide in accordance with Division 01 and the requirements of this section.

END OF SECTION 230500

SECTION 23 05 12 GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of motors for HVAC equipment.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

- A. All Division 1 Sections, GENERAL REQUIREMENTS.
- B. Section 01 33 00, SUBMITTAL PROCEDURES.
- C. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- D. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the University
- B. standards will govern.
- C. American Bearing Manufacturers Association (ABMA):
 - 1. 9-2015 Load Ratings and Fatigue Life for Ball Bearings
 - 2. 11-2014 Load Ratings and Fatigue Life for Roller Bearings
- D. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - 1. 90.1-2019 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings
- E. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 112-2017 Standard Test Procedure for Polyphase Induction Motors and Generators
 - 2. 841-2009 IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp)
- F. National Electrical Manufacturers Association (NEMA):
 - 1. MG 1-2016 (R2019) Motors and Generators
 - 2. MG 2-2014 Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
 - 3. 250-2020 Enclosures for Electrical Equipment (1000 Volts Maximum)
- G. National Fire Protection Association (NFPA):
 - 1. 70-2020 National Electrical Code (NEC)

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT", with applicable paragraph identification.
- C. Submit motor submittals with driven equipment.
- D. Shop Drawings:
 - 1. Provide documentation to demonstrate compliance with contract documents.
 - 2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
- E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
- F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- G. Certification: Two weeks prior to final inspection, unless otherwise noted, certification shall be submitted to the EOR stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.
- H. Completed Prefunctional Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 AS-BUILT DOCUMENTATION

- A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 MOTORS

- A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.
- B. For severe duty TEFC motors, IEEE 841 shall apply.
- C. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR CONTROLLERS; and Section 26 05 19,

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors. Unless otherwise specified for a particular application, use electric motors with the following requirements.

- D. Single-phase Motors:
 - 1. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
 - a) In order to meet ASHRAE 90.1 requirements, motors for small packaged HVAC equipment may be Electrically Commutated motor (EC type). Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic communication. The motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds.
- E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
 - 1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.
- F. Voltage ratings shall be as follows:
 - 1. Single phase:
 - a) Motors connected to 120-volt systems: 115 volts.
 - b) Motors connected to 208-volt systems: 200 volts.
 - c) Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
 - 2. Three phase:
 - a) Motors connected to 208-volt systems: 200 volts.
 - b) Motors, less than 74.6 kW (100 hp), connected to 240-volt or 480-volt systems: 208-230/460 volts, dual connection.
 - c) Motors, 74.6 kW (100 hp) or greater, connected to 240-volt systems: 230 volts.
 - d) Motors, 74.6 kW (100 hp) or greater, connected to 480-volt systems: 460 volts.
 - e) Motors connected to high voltage systems (Over 600V): Shall conform to NEMA MG 1 for connection to the nominal system voltage shown in the contract documents.
- G. Number of phases shall be as follows:
 - 1. Motors, less than 373 W (1/2 hp): Single phase.
 - 2. Motors, 373 W (1/2 hp) and greater: 3 phase.
 - 3. Exceptions:
 - a) Hermetically sealed motors.
 - b) Motors for equipment assemblies, less than 746 W (1 hp), shall be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- H. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.
- I. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration, and running torque without exceeding nameplate ratings or considering service factor.

J. Motor Enclosures:

1. Shall be the NEMA types as specified and/or shown in the contract documents.
2. Where the types of motor enclosures are not shown in the contract documents, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
 - a) Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
 - b) Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
 - c) Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

K. Electrical Design Requirements:

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (176 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General-Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both, or NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors.

L. Mechanical Design Requirements:

1. Bearings shall be rated in accordance with ABMA 9 or ABMA 11 for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hours rating. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and greater shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.

11. Winding thermostats, when specified shall be normally closed, connected in series.
 12. Grounding provisions shall be in the main terminal box.
- M. Special Requirements:
1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the University.
 2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
 3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
 - a) Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
 - b) Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
 - c) Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
 4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
 5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that shall protect bearings from damage from stray currents.
- N. Additional requirements for specific motors, as indicated in the other sections listed in Article, RELATED SECTIONS shall also apply.
- O. NEMA Premium Efficiency Electric Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 W (1 hp) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 W (1 hp) or more with open, drip-proof, or TEFC enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Premium Efficiencies Open Drip-Proof				Minimum Premium Efficiencies Totally Enclosed Fan-Cooled (TEFC)			
Rating kW (hp)	1200 RPM	1800 RPM	3600 RPM	Rating kW (hp)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%

7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%

- P. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM, and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.90 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.
- Q. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency			
Rating kW (hp)	6 poles	4 poles	2 poles	Rating kW (hp)	6 poles	4 poles	2 poles
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6
0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown in the contract documents and/or as required by other sections of these specifications.
- B. If in the substantiated evaluation of the State or the CxA, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the State, the Contractor shall correct the installation at no additional cost or time to the University.

3.2 FIELD TESTS

- A. All tests shall be witnessed by the CxA.
- B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.
- C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.
- D. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.
- E. All test data shall be compiled into a report form for each motor and provided to the contracting officer or their representative.

3.3 STARTUP AND TESTING

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the University.
- C. The CxA shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with University and the CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification shall be tested as part of a greater system.

END OF SECTION 230512

SECTION 23 05 14 MOTOR CONTROLLERS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of all motor controllers.

1.2 RELATED WORK

- A. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, Submittal Procedures, and the following requirements:
 - 1. Shop Drawings:
 - a) Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b) Include electrical ratings, dimensions, weights, mounting details, materials, overcurrent protection devices, overload relays, sizes of enclosures, wiring diagrams, starting characteristics, interlocking, and accessories.
 - 2. Manuals:
 - a) Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - 1) Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.
 - 2) Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
 - 3) Elementary schematic diagrams shall be provided for clarity of operation.
 - 4) Include the catalog numbers for the correct sizes of overload relays for the motor controllers.
 - b) If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
 - 3. Certifications: Two weeks prior to final inspection, submit the following.
 - a) Certification by the manufacturer that the motor controllers conform to the requirements of the drawings and specifications.
 - b) Certification by the Contractor that the motor controllers have been properly installed, adjusted, and tested.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. International Code Council (ICC):
IBC-21 International Building Code
- C. Institute of Electrical and Electronic Engineers (IEEE):
519-22 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
C37.90.1-12 Standard Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- D. National Electrical Manufacturers Association (NEMA):
ICS 1-22 Industrial Control and Systems: General Requirements
ICS 1.1-84(R2020) Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
ICS 2-00(R2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts
ICS 4-15 Industrial Control and Systems: Terminal Blocks
ICS 6-93(R2016) Industrial Control and Systems: Enclosures
ICS 7-20 Industrial Control and Systems: Adjustable-Speed Drives
ICS 7.1-14 Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems
- E. National Fire Protection Association (NFPA):
70-23 National Electrical Code (NEC)
- F. Underwriters Laboratories Inc. (UL):
508A-18 Industrial Control Panels
508C-20 Power Conversion Equipment
1449-21 Surge Protective Devices

PART 2 - PRODUCTS

2.1 MOTOR CONTROLLERS

- A. Motor controllers shall comply with IEEE, NEMA, NFPA, UL, and as shown on the drawings.
- B. Motor controllers shall be separately enclosed, unless part of another assembly.
- C. Motor controllers shall be combination type, with magnetic controller per Paragraph 2.3 below and with motor circuit protector for motors less than 3HP, motor circuit breakers for motors 3HP and greater, and disconnecting means, with external operating handle with lock-open padlocking positions and ON-OFF position indicator.
 - 1. Circuit Breakers:
 - a) Bolt-on thermal-magnetic type with a minimum interrupting rating as indicated on the drawings.
 - b) Equipped with automatic, trip free, non-adjustable, inverse-time, and instantaneous magnetic trips for less than 400A. The magnetic trip shall be adjustable from 5x to 10x for breakers 400A and greater.
 - c) Additional features shall be as follows:

- 1) A rugged, integral housing of molded insulating material.
 - 2) Silver alloy contacts.
 - 3) Arc quenchers and phase barriers for each pole.
 - 4) Quick-make, quick-break, operating mechanisms.
 - 5) A trip element for each pole, a common trip bar for all poles, and one operator for all poles.
2. Motor Circuit Protectors:
 - a) Magnetic trip only.
 - b) Bolt-on type with a minimum interrupting rating as indicated on the drawings.
 - c) Equipped with automatic, adjustable magnetic trip. Magnetic trip shall be adjustable up to 1300% of the motor full load amperes.
- D. Enclosures:
 1. Enclosures shall be NEMA-type rated 1, 3R, or 12 as indicated on the drawings or as required per the installed environment.
 2. Enclosure doors shall be interlocked to prevent opening unless the disconnecting means is open. A "defeater" mechanism shall allow for inspection by qualified personnel with the disconnect means closed. Provide padlocking provisions.
 3. All metal surfaces shall be thoroughly cleaned, phosphatized, and factory primed prior to applying light gray baked enamel finish.
- E. Motor control circuits:
 1. Shall operate at not more than 120 Volts.
 2. Shall be grounded, except where the equipment manufacturer recommends that the control circuits be isolated.
 3. For each motor operating over 120 Volts, incorporate a separate, heavy duty, control transformer within each motor controller enclosure.
 4. Incorporate primary and secondary overcurrent protection for the control power transformers.
- F. Overload relays:
 1. Thermal type. Devices shall be NEMA type.
 2. One for each pole.
 3. External overload relay reset pushbutton on the door of each motor controller enclosure.
 4. Overload relays shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 5. Thermal overload relays shall be tamperproof, not affected by vibration, manual reset, sensitive to single-phasing, and shall have selectable trip classes of 10, 20 and 30.
- G. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular controller. H-O-A switch shall be operable without opening enclosure door. H-O-A switch is not required for manual motor controllers.
- H. Incorporate into each control circuit a 120 Volt, electronic time-delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time-delay relay is not required where H-O-A switch is not required.
- I. Unless noted otherwise, equip each motor controller with not less than two normally open (N.O.) and two normally closed (N.C.) auxiliary contacts.
- J. Provide green (RUN) and red (STOP) pilot lights.

- K. Motor controllers incorporated within equipment assemblies shall also be designed for the specific requirements of the assemblies.
- L. Additional requirements for specific motor controllers, as indicated in other specification sections, shall also apply.

2.2 MANUAL MOTOR CONTROLLERS

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Manual motor controllers shall have the following features:
 - 1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
 - 2. Units shall include thermal overload relays, on-off operator, red pilot light, normally open auxiliary contacts.
- C. Fractional horsepower manual motor controllers shall have the following features:
 - 1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
 - 2. Units shall include thermal overload relays, red pilot light, and toggle operator.

2.3 MAGNETIC MOTOR CONTROLLERS

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Controllers shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum NEMA size 0.
- C. Where combination motor controllers are used, combine controller with protective or disconnect device in a common enclosure.
- D. Provide phase loss protection for each controller, with contacts to de-energize the controller upon loss of any phase.
- E. Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and opened by gravity. For motors 75 HP and larger, provide reduced-voltage or variable speed controllers as shown on the drawings. Equip controllers with 120 VAC coils and individual control transformer unless otherwise noted.

2.4 REDUCED VOLTAGE MOTOR CONTROLLERS

- A. Shall be in accordance with applicable portions of 2.1 above.
- B. Shall have closed circuit transition.
- C. Shall limit inrush currents to not more than 70 percent of the locked rotor current.
- D. Provide phase loss protection for each motor controller, with contacts to de-energize the motor controller upon loss of any phase.

2.5 LOW-VOLTAGE VARIABLE SPEED MOTOR CONTROLLERS (VFD)

- A. VFD shall be in accordance with applicable portions of 2.1 above.
- B. VFD shall be electronic, with adjustable frequency and voltage, three phase output, capable of driving standard NEMA B three-phase induction motors at full rated speed. The control technique shall be pulse width modulation (PWM), where the VFD utilizes a full wave

bridge design incorporating diode rectifier circuitry. Silicon controlled rectifiers or other control techniques are not acceptable.

- C. VFD shall be suitable for variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.
- D. VFD shall be capable of operating within voltage parameters of plus 10 to minus 15 percent of line voltage and be suitably rated for the full load amps of the maximum watts (HP) within its class.
- E. Minimum efficiency shall be 95 percent at 100 percent speed and 85 percent at 50 percent speed.
- F. The displacement power factor of the VFD shall not be less than 95 percent under any speed or load condition.
- G. VFD current and voltage harmonic distortion shall not exceed the values allowed by IEEE 519.
- H. Operating and Design Conditions:
 - 1. Elevation: 4500 feet Above Mean Sea Level (AMSL)
 - 2. Temperatures: Maximum +90°F
 - 3. VFD Location: conditioned space
- I. VFD shall have the following features:
 - 1. Isolated power for control circuits.
 - 2. Manually resettable overload protection for each phase.
 - 3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
 - 4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 2000 seconds. Set timers to the equipment manufacturer's recommended time in the above range.
 - 5. Control input circuitry that will accept 4 to 20 mA current or 0-10 VDC voltage control signals from an external source.
 - 6. Automatic frequency adjustment from 1 Hz to 300 Hz.
 - 7. Circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The VFD shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected. The VFD shall be able to restart into a rotating motor operating in either the forward or reverse direction and matching that frequency.
 - a) Incorrect phase sequence.
 - b) Single phasing.
 - c) Overvoltage in excess of 10 percent.
 - d) Undervoltage in excess of 15 percent.
 - e) Running overcurrent above 110 percent (VFD shall not automatically reset for this condition.)
 - f) Instantaneous overcurrent above 150 percent (VFD shall not automatically reset for this condition).
 - g) Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)
 - 8. Automatic Reset/Restart: Attempt three restarts after VFD fault or on return of power after an interruption and before shutting down for manual reset or fault correction, with adjustable delay time between restart attempts.

9. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
10. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to VFD, motor, or load.
- J. VFD shall include an input circuit breaker which will disconnect all input power, interlocked with the door so that the door cannot be opened with the circuit breaker in the closed position.
- K. VFD shall include a 5% line reactor and a RFI/EMI filter.
- L. Surge Suppression: Provide three-phase protection against damage from supply voltage surges in accordance with UL 1449.
- M. VFD shall include front-accessible operator station, with sealed keypad and digital display, which allows complete programming, operating, monitoring, and diagnostic capabilities.
 1. Typical control functions shall include but not be limited to:
 - a) HAND-OFF-AUTOMATIC-RESET, with manual speed control in HAND mode.
 - b) NORMAL-BYPASS.
 - c) NORMAL-TEST, which allows testing and adjusting of the VFD while in bypass mode.
 2. Typical monitoring functions shall include but not be limited to:
 - a) Output frequency (Hz).
 - b) Motor speed and status (run, stop, fault).
 - c) Output voltage and current.
 3. Typical fault and alarm functions shall include but not be limited to:
 - a) Loss of input signal, under- and over-voltage, inverter overcurrent, motor overload, critical frequency rejection with selectable and adjustable deadbands, instantaneous line-to-line and line-to-ground overcurrent, loss-of-phase, reverse-phase, and short circuit.
 - b) System protection indicators indicating that the system has shut down and will not automatically restart.
- N. VFD shall include two N.O. and two N.C. dry contacts rated 120 Volts, 10 amperes, 60 Hz.
- O. Hardware, software, network interfaces, gateways, and programming to control and monitor the VFD by control systems specified in other specification sections, including but not limited to Divisions 22 and 23.
- P. Network communications ports: As required for connectivity to control systems specified in other specification sections, including but not limited to Divisions 22 and 23.
- Q. Communications protocols: As required for communications with control systems specified in other specification sections, including but not limited to Divisions 22 and 23.
- R. Bypass controller: Provide contactor-style bypass, arranged to bypass the inverter.
 1. Inverter Output Contactor and Bypass Contactor: Load-break NEMA-rated contactor.
 2. Motor overload relays.
 3. HAND-OFF-AUTOMATIC bypass control.

- S. Bypass operation: Transfers motor between inverter output and bypass circuit, manually, automatically, or both. VFD shall be capable of stable operation (starting, stopping, and running), and control by fire alarm and detection systems, with motor completely disconnected from the inverter output. Transfer between inverter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.
- T. Inverter Isolating Switch: Provide non-load-break switch arranged to isolate inverter and permit safe troubleshooting and testing of the inverter, both energized and de-energized, while motor is operating in bypass mode. Include lockable, door-mounted handle mechanism.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, as shown on the drawings, and as specified.
- B. In seismic areas, motor controllers shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.
- C. Install manual motor controllers in flush enclosures in finished areas.
- D. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.
- E. Program variable speed motor controllers per the manufacturer's instructions and in coordination with other trades so that a complete and functional system is delivered.
- F. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

3.2 Acceptance Checks and Tests

- A. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
 - 1. Visual Inspection and Tests:
 - a) Compare equipment nameplate data with specifications and approved shop drawings.
 - b) Inspect physical, electrical, and mechanical condition.
 - c) Verify appropriate anchorage, required area clearances, and correct alignment.
 - d) Verify that circuit breaker, motor circuit protector, and fuse sizes and types correspond to approved shop drawings.
 - e) Verify overload relay ratings are correct.
 - f) Vacuum-clean enclosure interior. Clean enclosure exterior.
 - g) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - h) Test all control and safety features of the motor controllers.

- i) For low-voltage variable speed motor controllers, final programming and connections shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

3.3 SPARE PARTS

- A. Two weeks prior to the final inspection, provide one complete set of spare fuses for each motor controller.

3.4 INSTRUCTION

- A. Furnish the services of a factory-trained technician for two 4-hour training periods for instructing personnel in the maintenance and operation of the motor controllers, on the dates requested by the campus facilities.

END 23 05 14 MOTOR CONTROLLERS FOR HVAC EQUIPMENT

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gate valves.
 - 2. Globe valves.
 - 3. Ball valves.
 - 4. Plug valves.
 - 5. Butterfly valves.
 - 6. Check valves
 - 7. Pressure and Safety relieve valves.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A216 / A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
 - 2. ASTM D1785 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- B. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

PART 2 - PRODUCTS

2.1 GATE VALVES

- A. Manufacturers:
 - 1. Crane.
 - 2. Milwaukee.
 - 3. Nibco
- B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, rising stem, inside screw solid wedge disc, solder or threaded ends.
- C. 2-1/2 inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 GLOBE VALVES

- A. Manufacturers:
 - 1. Crane
 - 2. Milwaukee
 - 3. Nibco

- B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, hand wheel, Buna-N composition disc, solder or threaded ends.
- C. 2-1/2 inches and Larger: MSS SP 85, Class 125, cast iron body, bronze trim, hand wheel, outside screw and yoke, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.3 BALL VALVES

- A. Manufacturers:
 - 1. Crane
 - 2. Milwaukee
 - 3. Nibco
- B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded end and handle with balancing stops.

2.4 PLUG VALVES

- A. Manufacturers:
 - 1. Nordstrom
 - 2. Dezurik
 - 3. Crane
- B. 2 inches and Smaller: MSS SP 78, Class 300, cast iron construction, round port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
- C. 2-1/2 inches and Larger: MSS SP 78, Class 300, cast iron construction, round port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated or worm gear-operated.

2.5 BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Crane
 - 2. Milwaukee
 - 3. Nibco
- B. 2-1/2 inches and Larger: MSS SP 67, Class 200.
 - 1. Body: Cast or ductile iron, lug or grooved ends, stainless steel stem, extended neck.
 - 2. Disc: Aluminum bronze.
 - 3. Seat: Resilient replaceable EPDM.
 - 4. Handle and Operator: Infinite position lever handle with memory stop. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.6 CHECK VALVES

- A. Horizontal Swing Check Valves:
 - 1. Manufacturers:
 - a) Crane
 - b) Milwaukee
 - c) Nibco

2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N, solder or threaded ends.
 3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.
- B. Spring Loaded Check Valves:
1. Manufacturers:
 - a) Crane.
 - b) Milwaukee
 - c) Nibco
 2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
 3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves with clearance for installation of insulation and allowing access.
- C. Provide access where valves and fittings are not accessible.

3.2 VALVE APPLICATIONS

- A. Install shutoff and drain valves at locations in accordance with this Section.
- B. Install butterfly or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball butterfly or globe valves for throttling, bypass, or manual flow control services.
- D. Install spring loaded check valves on discharge of water pumps.
- E. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- F. If valve applications are not indicated, use the following:
 1. Shutoff Service: Ball, butterfly gate, or plug valves.
 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 3. Throttling and By-Pass Service: Globe, ball, or butterfly valves.
 4. Pump-Discharge Check Valves: Center-guided silent check valves.
 5. Lubricated plug valves may be used for throttling service. Non-lubricated plug valves may be used only when shut-off or isolating valves are also provided.
 6. Install drain valves, with cap and chain, as noted.
 - a) All applications use 3/4 inch ball or globe valves.
 7. Provide 1/4 inch ball valve as gauge cocks.
- G. Safety and Relief Valves:
 1. Constructed, rated and stamped in accordance with ASME
 - a) Install relief valves for unheated liquids.
 - b) Install safety relief valves for heated liquids.
 - c) Install safety valves for steam.
 2. Set Pressures and Ratings:

- a) Suitable and rated for system pressure and temperature.
 - 1) For Safety Relief Valves: Minimum temperature rating shall be equal to saturated steam temperature corresponding to pressure 10 percent higher than valve set pressure.
- b) Set pressure; not to exceed pressure rating of protected equipment.
- 3. Valves to open, under test, at set pressure with following tolerance:
 - a) Set pressure up to 70 psi: Plus or minus 2 psi.
 - b) Set pressure, above 70 psi: Plus or minus 3 percent.
- 4. Capacities: Selected and sized to:
 - a) Relieve maximum possible generated energy.
 - b) Maintain pressure in protected equipment at not more than following:
 - 1) Low Pressure Boilers: 5 psi above boiler working pressure.
 - 2) Unfired Pressure Vessels: 10 percent above vessel working pressure.
- 5. Provide multiple valves if required to meet capacity requirements.
- H. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- I. Select valves, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve- end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve- end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve- end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 - 7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

3.3 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, brass with brass trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.
 - 4. Bronze Gate Valves: Class 125, RS.
 - 5. Bronze Globe Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
 - 3. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, EPDM seat, aluminum-bronze disc.
 - 4. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
 - 5. Iron Swing Check Valves: Class 125, metal seats.
 - 6. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
 - 7. Iron, Center-Guided Check Valves: Class 125, globe, metal seat.
 - 8. Iron Gate Valves: Class 125, OS&Y.

9. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

END OF SECTION 23 05 23

SECTION 23 05 41 NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the application of noise control measures, tolerance and vibration isolation for HVAC work, and vibration control techniques to boiler plant rotating equipment and parts including chillers, cooling towers, boilers, pumps, fans, compressors, motors, and steam turbines.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

- A. All Division 1 Sections, GENERAL REQUIREMENTS.
- B. Section 01 33 00, SUBMITTAL PROCEDURES.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the Idaho State Codes will govern.
- B. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7-2016 Minimum Design Loads for Buildings and Other Structures
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - 1. Handbook-2019 ASHRAE Handbook – HVAC Applications
 - 2. Handbook-2021 ASHRAE Handbook - Fundamentals, Chapter 8, Sound and Vibration
- D. American Society for Testing and Materials (ASTM):
 - 1. A123/A123M-2017 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. A307-2021 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
 - 3. B117-2019 Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 4. D2240-2015(R2021) Standard Test Method for Rubber Property - Durometer Hardness
- E. International Code Council (ICC):
 - 1. IBC-2021 International Building Code
- F. Manufacturers Standardization Society (MSS):
 - 1. SP-58-2018 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation
- G. Occupational Safety and Health Administration (OSHA):
 - 1. 29 CFR 1910.95 Occupational Noise Exposure
- H. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):

1. 001-2008 Seismic Restraint Manual: Guidelines for Mechanical Systems, 3rd Edition

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 1. Vibration isolators:
 - a) Floor mountings
 - b) Hangers
 - c) Snubbers
 - d) Thrust restraints
 2. Bases.
 3. Seismic restraint provisions and bolting.
 4. Acoustical enclosures.
- D. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

1.5 QUALITY ASSURANCE

- A. Noise Criteria:
 1. Perform an acoustic analysis to demonstrate that the specified room noise levels are achieved in all octave bands for all air-handling units, heating and ventilating units, fans, chillers, boilers, generators, and outdoor noise producing equipment, such as cooling towers and chillers. Refer to the ASHRAE Handbook - HVAC Applications. The analysis shall consider both air duct borne noise and noise transmission through walls, floors and roofs and shall be completed for all duct systems and all HVAC equipment.
 2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA 29 CFR 1910.95 requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Handbook - Fundamentals, Chapter 8, Sound and Vibration.
 3. An allowance, not to exceed 5 db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.
 4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

- B. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

PART 2 - PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer. Refer to ASHRAE Handbook - HVAC Applications Chapter 49, Noise and Vibration Control, Table 47 for selection guide for Vibration Isolation.
- B. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.
- C. Exposure to Weather: Isolator housings to be either hot dipped galvanized or powder coated to ASTM B117 salt spray testing standards. Springs to be powder coated or electro galvanized. All hardware to be electro galvanized. In addition, provide limit stops to resist wind velocity. Velocity pressure established by wind shall be calculated in accordance with Section 1609 of the International Building Code. A minimum wind velocity of 75 mph shall be employed.
- D. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- E. Color code isolators by type and size for easy identification of capacity.

2.2 VIBRATION ISOLATORS

- A. Floor Mountings:
 - 1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
 - 2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
 - 3. Captive Spring Mount for Seismic Restraint (Type SS):
 - a) Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4 inch) before contacting snubbers. Mountings shall have a minimum rating of one G coefficient of gravity as calculated and certified by a registered structural engineer.
 - b) All mountings shall have leveling bolts that are rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid

- equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.
4. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. Isolators shall have a minimum seismic rating of one G.
 5. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be natural rubber or neoprene waffle, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).
- B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.
1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
 2. Hanger supports for piping 50 mm (2 inches) and greater shall have a pointer and scale deflection indicator.
- C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3.2 mm (1/8 inch) nor greater than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.
- D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.3 BASES

- A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (4 inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.
- B. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level the concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than 152 mm (6 inches). Form shall include 13 mm (1/2 inch) reinforcing bars welded in place on minimum of 203 mm (8 inch) centers running both ways in a layer 38 mm (1-1/2 inches) above bottom. Use height saving

brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 1.6 mm (1/16 inch).

- C. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 6 mm (1/4 inch) clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. If an installation is unsatisfactory to the EOR, the contractor shall correct the installation at no additional cost or time to the State.
- B. Vibration Isolation:
 - 1. No metal-to-metal contact will be permitted between fixed and floating parts.
 - 2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports with a deflection equal to that used on the corresponding equipment.
 - 3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
 - 4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (100 degrees F).
 - 5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
 - 6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.
- C. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

- A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 6 mm (1/4 inch) movement during start and stop.
- D. Adjust active height of spring isolators.

- E. Adjust snubbers according to manufacturer's recommendations.
- F. Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces.

END OF SECTION 230541

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the identification of piping, both new and existing.

1.2 RELATED WORK

- A. All DIVISION 1 - GENERAL REQUIREMENTS Sections
- B. Section 230500 – COMMON WORK RESULTS FOR HVAC
- C. Section 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC
- D. Section 230800 – COMMISSIONING OF HVAC
- E. Section 230900 – INSTRUMENTATION AND CONTROL FOR HVAC

1.3 SUMMARY

- A. Section Includes:
 - 1. Equipment labels
 - 2. Pipe labels
 - 3. Valve tags

1.4 SUBMITTALS

- A. Product Data: For each type of product
- B. Samples: Color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme
- E. Valve Schedules: Each piping system to be included and provided in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the work included, but are not limited to:
 - a Brady Corporation
 - b Brimar Industries, Inc.
 - c Carlton Industries, LP.
 - d Champion America.
 - e Craftmark Pipe Markers.
 - f LEM Products Inc.

- g Marking Services, Inc.
 - h Seton Identification Products.
 - 2. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 3. Letter Color: Black.
 - 4. Background Color: White.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2- 1/2 by 3/4 inch
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a Brady Corporation.
 - b Brimar Industries, Inc.
 - c Carlton Industries, LP.
 - d Champion America.
 - e Craftmark Pipe Markers.
 - f LEM Products Inc.
 - g Marking Services, Inc.
 - h Seton Identification Products.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 3. Letter Color: White.
 - 4. Background Color: Blue.
 - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F
 - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2- 1/2 by 3/4 inch.
 - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 8. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Carlton Industries, LP.
 - 5. Champion America.
 - 6. Craftmark Pipe Markers.
 - 7. Marking Services Inc.
 - 8. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2.3 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Carlton Industries, LP.
 - 5. Champion America.
 - 6. Craftmark Pipe Markers.
 - 7. Marking Services Inc.
 - 8. Seton Identification Products.
- B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
- C. Tag Material: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT INSTALLATION

- A. coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Install or permanently fasten labels on each major item of mechanical equipment.
- E. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels on all hot water piping, including existing piping in the gym and mechanical room and as follows:
 - 1. Place 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 and on both sides of 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 to 15 feet in areas of congested piping and equipment.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule:
 - 1. Hot Water Piping: Black letters on a yellow background.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape: Chilled and Hot Water: 1-1/2 inches round.
 - 2. Valve-Tag Colors: Hot Water: White letters on a safety-green background.
 - 3. Valve-Tag Colors: Chilled Water: White letters on a safety-blue background.

END OF SECTION 230553

SECTION 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
 - 1. Planning systematic TAB procedures.
 - 2. Design Review Report.
 - 3. Systems Inspection report.
 - 4. Systems Readiness Report.
 - 5. Balancing water distribution systems; adjustment of total system flow to provide design flows.
 - 6. Balancing existing air distribution systems; adjustment of total system flow to provide design flows.
 - 7. Recording and reporting results
 - 8. Document critical paths of flow and deficiencies on reports.
- B. Definitions:
 - 1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of 2019 ASHRAE Handbook, "HVAC Applications".
 - 2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
 - 3. AABC: Associated Air Balance Council.
 - 4. NEBB: National Environmental Balancing Bureau.
 - 5. TABB: Testing Adjusting and Balancing Bureau
 - 6. Hydronic Systems: Includes hot water only.
 - 7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

- A. All DIVISION 1 - GENERAL REQUIREMENTS Sections
- B. Section 230500 – COMMON WORK RESULTS FOR HVAC
- C. Section 230800 – COMMISSIONING OF HVAC
- D. Section 230900 – INSTRUMENTATION AND CONTROL FOR HVAC
- E. Section 232113 – HYDRONIC PIPING
- F. Section 232213 – STEAM AND CONDENSATE PIPING

1.3 QUALITY ASSURANCE

- A. Refer to Articles, COMMON WORK RESULTS FOR HVAC, Section 23 05 00, COMMON WORK RESULTS FOR HVAC and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. The following TAB contractors are preapproved to bid this project: BST, NWESI, and Florite. Anyone not listed must follow the instructions outlined in section 012500 Substitutions for preapproval.

C. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
2. The TAB agency shall be either a certified member of AABC, TABB or NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the EOR and submit another qualified TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC, TABB or NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
3. TAB Specialist: The TAB specialist shall be either a member of AABC or TABB or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required.. The responsibilities would specifically include:
 - a. Shall directly supervise all TAB work.
 - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC, TABB or NEBB.
 - c. Would follow all TAB work through its satisfactory completion.
 - d. Shall provide final markings of settings of all HVAC adjustment devices.
 - e. Permanently mark location of duct test ports.
 - f. Shall document critical paths from the fan or pump. These critical paths are ones in which are 100% open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.
5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC, TABB or NEBB

- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards, TABB/SMACNA International Standards, or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. TAB Criteria:
 - 1. One or more of the applicable AABC, NEBB, TABB or SMACNA publications, supplemented by ASHRAE Handbook "2019 HVAC Applications" Chapter 39, and requirements stated herein shall be the basis for planning, procedures, and reports.
 - 2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow 2011 ASHRAE Handbook "2019 HVAC Applications", Chapter 39, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
 - a. Airside systems, including fans: Minus 5 percent to plus 5 percent of design.
 - 3. Typical TAB procedures and critical path results shall be demonstrated to the Commissioning Authority for one hydronic system (pump) as follows:
 - a. When field TAB work begins or as coordinated with the Commissioning Authority.

1.4 SUBMITTALS

- A. Submit in accordance with Specification section 013300 – SUBMITTAL PROCEDURES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the Engineer of Record staff, submit one complete set of applicable AABC, NEBB or TABB publications that will be the basis of TAB work.
- D. Submit following for review and review and approval
 - 1. Design review report within 30 days of prime contractor's notice to proceed by the State of Idaho.
 - 2. Systems inspection report on equipment and installation for conformance with design.
 - 3. Systems readiness report
 - 4. Intermediate and Final TAB reports covering flow balance and adjustments, and any performance tests.
 - 5. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
 - 6. Include in each report the critical path for each balanced branch (hydronic).
- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

PART 2 - PRODUCTS

2.1 INSULATION REPAIR MATERIAL

- A. Coordinate repair of any insulation removed or damaged as part of the TAB work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Obtain applicable contract documents including drawings and specifications as well as copies of approved submittals prior to starting work.
- B. Coordinate necessary work with prime contractor, RTU startup technicians and control contractor prior to starting TAB. It is the responsibility of the TAB contractor to contact the DDC contractor and schedule a date for TAB work as well as any requirements for system posturing.
- C. Coordinate any required review of system TAB observation with Commissioning Authority prior to starting TAB.

3.2 DESIGN REVIEW REPORT

- A. The TAB Specialist shall review the Contract Plans and specifications and advise the Resident Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

- A. Inspect equipment and installation for conformance with design.
- B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA (TABB), supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 SYSTEM READINESS REPORT

- A. The TAB Contractor shall measure existing water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to engineer of record
- B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to engineer of record in standard format and forms prepared and or approved by the Commissioning Agent.

- C. Verify that all items such as piping, ductwork, valves, ports, terminals, connectors, etc., that is required for TAB are installed. Coordinate the installation of any missing appurtenances with the prime contractor.

3.5 TAB Reports

- A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.
- B. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.
- C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated after engineering and construction have been evaluated and re-submitted for approval at no additional cost to the owner.
- D. Do not proceed with the remaining systems until intermediate report is approved by the Engineer of Record

3.6 TAB PROCEDURES

- A. Submit a shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC, TABB or NEBB. Balancing shall be done proportionally to all applicable systems.
- B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre-construction and water flow rate prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre constructed conditions.
- D. Allow 7 days' time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- E. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers. This includes verification of chilled and hot waters flowrates at each existing fan coil receiving a new autoflow device.
- F. Air Balance and Equipment Test: Include fans and main supply ductwork.

END OF SECTION 230593

SECTION 230700 – HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements in this section apply to all new installed piping and any existing piping in which insulation has been damaged as a result of work.
- C. Requirements in this section apply to all new installed ductwork and any existing ductwork connected to RTUs.

1.2 RELATED WORK

- A. All DIVISION 1 - GENERAL REQUIREMENTS Sections
- B. Section 230500 – COMMON WORK RESULTS FOR HVAC

1.3 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Flexible Elastomeric.
 - b. Mineral fiber.
 - c. Fiberglass Blanket Wrap.
 - 2. Jackets and fitting covers

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 DELIVERY STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish

and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) Fibrex Insulations Inc.; Coreplus 1200.
 - b) Johns Manville; Micro-Lokproducts shall not contain asbestos, lead, mercury,
 - c) Knauf Insulation; 1000 Pipe Insulation.
 - d) Manson Insulation Inc.; Alley-K.
 - e) Owens Corning; Fiberglas Pipe Insulation
 - 2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 3. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL
- D. Mineral-Fiber, Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) CertainTeed Corp., Duct Wrap.
 - b) Johns Manville; Microlite.
 - c) Knauf Insulation; Duct Wrap.
 - d) Manson Insulation Inc.; Alley Wrap.

e) Owens Corning; All-Service Duct Wrap.

E. Polyisocyanurate Closed-Cell Rigid

1. Preformed (fabricated) pipe insulation, ASTM C591, type IV, $K=0.027(0.19)$ at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with polyvinyl chloride premolded fitting covers.
2. Equipment and duct insulation, ASTM C 591, type IV, $K=0.027(0.19)$ at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

2.2 JACKETS AND FITTING COVERS

A. PVC Plastic Jacket and Fitting Covers (Interior Applications):

1. Manufacturers:
 - a) Zeston 2000
2. Jackets and fitting covers: ASTM D1784; one piece molded type fitting covers and sheet material; off-white color; minimum service temperature: 0 °F; maximum service temperature: 450 °F; thickness: 20 mil.
3. Jackets and fitting covers (vapor barrier jackets): ASTM D1784; one piece molded type fitting covers and sheet material; off-white color; minimum service temperature: 0 °F; maximum service temperature: 450 °F; moisture vapor transmission - ASTM E96 - 0.002 perm-inches; thickness: 20 mil.
4. Connections: Pressure sensitive color matching vinyl tape

B. Duct insulation systems are required to have factory-applied jackets. Comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing: complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure sensitive, acrylic-based adhesive covered by a removable protective strip: complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum foil, fiberglass-reinforced scrim with kraft-paper backing: complying with ASM C1136, Type II.

C. Aluminum Jacket-Piping: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless-steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. For indoor applications, use adhesive that has a VOC content of 80 g/L or less.

2.4 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive: complying with ASTM C 1136
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
- D. Aluminum-Foil Tape: Vapor-barrier tape with acrylic adhesive.

2.5 MASTIC

- A. Materials shall be compatible with insulation materials, jackets, and substrates: comply with MIL-C-1956C, Type II
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less.
- B. Vapor Barrier Mastic: Water based: suitable for indoor and outdoor use on below ambient services.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. All existing and new ductwork shall be reviewed and insulated.
- B. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation applications.
- B. Mix insulating cements with clean potable water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, hydronic and refrigerant pipe system
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a) For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Systems below Ambient Temperature (Chilled Water and DCW): 1-inch-thick glass fiber ($k = 0.21-0.27$) insulation with vapor barrier for pipe sizes less than 1-1/2 in. 1.5" thick insulation for pipes greater than 1-1/2 in.
 - 1. Maintain the vapor barrier integrity of all chilled water and DCW piping insulation installed indoors. PVC fitting cover seams shall be taped with vapor barrier tape by overlapping each surface a minimum of 1/2". Exposed mineral fiber insulation shall be sealed with mastic.
- C. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- E. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 BLANKET INSULATION INSTALLATION ON DUCTS AND PLENUMS: Secure with adhesive and insulation pins.

- #### A.
- Apply adhesives according to manufacturer's recommended coverage rates per unit area, for duct and plenum surfaces.

- B. Install either capacitor discharge weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts.
- C. For ducts and plenums, both new and existing, with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2"-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams and protrusions.
- D. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

3.8 JACKETS AND FITTING COVERS

- 1. Apply insulation prior to installation of jackets and fitting covers.
- 2. Pipe exposed in tunnels and insulated pipe located outdoors and insulated pipe penetrations through exterior walls: finish with aluminum jacket and fitting covers.
- 3. Pipe exposed in finished spaces less than 10 feet above finished floor, and where indicated on drawings: finish with PVC jacket and fitting covers.
- 4. Secure PVC jackets and fitting covers with stainless steel tacks and wrap seams and tacks with vinyl tape.
- 5. Install aluminum jackets on all piping exposed to outdoors.
- 6. Install aluminum jackets located outdoors with seams located on bottom side of horizontal piping. Apply sealing compound and closures to make weathertight.
- 7. Make any necessary repairs to damaged insulation

END OF SECTION 230700

SECTION 230800 – COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Attention is directed to the printed form of Contract and General Conditions and Supplementary Conditions which are hereby made a part of this Section of the Specifications.
- B. Furnish all labor, materials, equipment and services necessary to provide the owner with fully functional HVAC systems.
- C. Commissioning: Commissioning (Cx) is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meet the defined objectives and criteria set by the Owners.
- D. Commissioning Team: The members of the Cx team consist of the owner's contracted commissioning authority (CxA), the owner's representative or construction manager (CM), the general contractor (GC), the architect (Arch) and the design engineers (Engs), the mechanical Contractors (MC), the electrical contractor (EC), the testing and balancing (TAB) contractor, the control contractor (CC), the facility operating staff, and any other subContractors or suppliers of equipment. The CxA directs and coordinates the project Cx activities and reports to the owner. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contracted documents. Commissioning Shall:
 - 1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations, and industry accepted minimum standards and that they receive adequate operational checkout by installing Contractors.
 - 2. Verify and document proper performance of equipment and systems.
 - 3. Verify that O&M documentation left on site is complete.
 - 4. Verify that the owner's operating personnel are adequately trained.
- E. The Cx process does not take away from or reduce the responsibility of the system designers or installing Contractors to provide a finished and fully functional product. Furthermore, it doesn't not remove any responsibilities, products or requirements of other specification sections. This includes equipment startup by manufacturer trained personnel.
- F. The general or HVAC contractors are not required to provide the CxA. An independent, third-party commissioning agent has been retained by the State of Idaho. Though the contractor is not required to provide a commissioning agent, requirements for participation in the commissioning process are included in this specification.

1.2 DESCRIPTION OF WORK

- A. The work of this Section shall include and provide all labor, tools, materials and equipment necessary for the CxA to verify installation and performance of the HVAC and Controls systems associated with the scope of work.

1.3 RELATED WORK IN OTHER SECTIONS & REFERENCED STANDARDS

- A. The following related work shall be furnished or performed under other Sections of these Specifications:
 - 1. 230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC
- B. Commissioning Plan documentation is to be provided by third party commissioning agent.
- C. ASHRAE Standard 202-2018
- D. IECC 2018

1.4 DEFINITIONS

- A. Commissioning Plan: The detailed process of checking and testing procedures, sequences of events, schedules, staffing plans, and management or administrative procedures required to provide a comprehensive coordinated approach for commissioning the systems and equipment described herein.
- B. CxA: Commissioning Authority. The main point of contact for the commissioning process and third-party technical representative of the owner. The Commissioning Authority will manage all commissioning activities on behalf of the Owner and will serve as the Owner's agent in review and approval of commissioning related services.
- C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
- F. Commissioning Representatives: Those members of the Contractor's staff, Sub-contractor's staff, Owner's staff, Architect's staff, or Owner's independent contractor assigned to participate in the commissioning process.
- G. Commissioning Manager: The Commissioning Representative of the Contractor and/or commissioning team, to manage and lead the commissioning effort on behalf of the Contractor and/or commissioning team.
- H. Commissioning Procedures: A series of checks, tests, and operational procedures, applied in specific sequences, to each system or equipment component to be commissioned and intended to demonstrate full system installation, performance, and functionality, in accordance with the design intent. The term "procedures" shall be used throughout this specification and the Project Commissioning Plan in reference to these checking, testing, and operational procedures.
- I. Pre-Functional Test: A test, or tests, of the static function and operation of equipment and systems using manual (direct observation) by the installing contractor prior, during and post-equipment startup. Systems Pre-Functional Performance Testing is meant to verify the as-built systems ability to operate trouble free in at least a limited fashion prior to TAB and Systems Functional Performance testing.
- J. Functional Performance Test: A test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods meant to

commence following the completion of startup/programming and Systems Pre-Functional Testing. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the RTU is tested interactively with the RTU functions to understand general functionality) performed by the Commissioning Agent with support from the contractor as needed. Systems are tested under various modes, such as during normal occupied, unoccupied or emergency modes. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Manufacturer startup and control system checkout is not considered Systems Functional Performance Testing. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.

- K. Pre-Functional Checklist: A list of items in the form of a checklist provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. The contractor is required to perform this work, populate checklist forms and submit them to the Commissioning Authority prior to scheduling functional testing. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation. However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system which may have been completed during manufacturer startup and programming. The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.
- L. Commissioning Plan: The detailed process of checking and testing procedures, sequences of events, schedules, staffing plans, and management or administrative procedures required to provide a comprehensive coordinated approach for commissioning the systems and equipment described herein.
- M. Commissioning Authority: The Commissioning Representative of the Owner. The Commissioning Authority will manage all commissioning activities on behalf of the Owner and will serve as the Owner's agent in review and approval of commissioning related services.
- N. System, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.5 INTENT

- A. It is the intention of this Specification is to require the Contractors performing work to cooperate with the CxA, to furnish all labor and equipment and measuring devices, to perform required measurements and tests to verify that the installed equipment and systems are performing in accordance with the construction documents.
- B. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating or construction management.
- C. HVAC system installation, start-up, testing and balancing, preparation of O&M manuals, and operator training are the responsibility of the HVAC Contractor, with coordination by the General Contractor, Construction Manager or other entity acting under the requirements of Division 1. Observation, verification and Cx are the responsibility of the CxA who is to be assisted by installing Contractors in system operation as needed. The Cx process does not relieve Contractors from the obligations to complete all portions of work

in a satisfactory and fully operational manner, nor does Cx remove any obligation the trades have for operation and maintenance manuals and training.

1.6 HVAC CONTRACTOR REQUIREMENTS

- A. Cx, Pre-Functional and Functional testing as defined by ASHRAE standard 202-2018 are mandatory requirements of this project. Provide any assistance needed to fully test systems in accordance with testing protocols.
- B. All applicable equipment submittals shall be forwarded to the CxA for review.
- C. No Functional Testing shall commence until the completion and submission of the manufacturer startup checklists and populated pre-functional checklists to the CxA. The CxA will provide blank pre-functional testing forms for the contractor to populate. Pre-functional testing forms shall be provided to the CxA in submittal form.
- D. No Functional Testing shall commence until all systems TAB is complete. Functional testing may commence, at the discretion of the CxA, once TAB is complete however only conditional acceptance can be achieved until the final TAB report is provided by the contractor to the CxA for review. Only after review and acceptance of the TAB report and tested values can final acceptance be achieved. The owner may elect to wait until final acceptance is achieved to consider the project substantially complete.
- E. The Cx responsibilities applicable to mechanical contractor and appropriate subcontractors are as follows:
 - 1. Provide startup by manufacturer trained personnel for all equipment in the contracted scope.
 - 2. Assist and cooperate with the Testing and Balancing (TAB) contractor and the CxA by:
 - a. Putting all equipment and systems into operation and continuing the operation during each working day of TAB and Cx as required.
 - b. Including cost of sheaves, belts, and filter changes that may be required by TAB.
 - c. Providing clearances for test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing.
 - d. Providing temperature and pressure taps according to the Construction Documents for TAB and Cx testing.
 - e. Assist the TAB in the location and operation of all volume, control, and fire/smoke dampers.
 - 3. List and clearly identify on the as-built drawings the locations of all P/T plugs, air-flow stations gauges, meters, sensors and all other such measure and verification devices.

4. Prepare a preliminary schedule for all pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CxA. Update the schedule as appropriate.
5. Notify the GC when pipe and duct system testing, flushing, cleaning, power distribution and startup of each piece of equipment and TAB will occur. Be responsible to notify the GC, ahead of time, when Cx activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that Cx processes are executed and that the CxA and GC both have the scheduling information needed to efficiently execute the Cx process.
6. Attend Cx scoping meetings and other meetings necessary to facilitate the Cx process.
7. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, together during equipment submittals to the CxA for review and approval. See this specification section for additional information and requirements for the O&M manuals.
8. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
9. Review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
10. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the PFTs from the CxA for all commissioned equipment. Submit to CxA for review and approval prior to startup.
11. During the startup and initial checkout process, execute the Mechanical related portions of the PFTs for all commissioned equipment. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CxA.
12. Address current outstanding issue log items before functional testing. Air and Water Pressure Testing and Air & Water Testing and Balancing (TAB) shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
13. Complete Prefunctional Test Checklists (PFTs) provided by the CxA and return these to the CxA.
14. Provide access for equipment to be tested, such as removing ceiling tiles.
15. Provide skilled technicians to execute starting of equipment and to execute the pre-functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.

16. Provide skilled technicians to assist with functional performance testing under the direction of the CxA for specified equipment outlined in the Cx Plan. Assist the CxA in interpreting the monitoring data, as necessary.
 17. Correct deficiencies (differences between specified and observed performance). The CxA will provide one (1) functional retest of commissioned equipment at no additional charge to the contractor(s). If repeated failures of the equipment and/or system require retest beyond the first retest, the contractor (s) will be back charged for the time of the CxA required to complete the additional retesting.
 18. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions. Provide assistance, cooperate and provide required materials to others as directed by the GC (and CxA) in the compilation of the O&M manuals. Prepare draft versions of the O&M Manual for use as the training syllabus.
 19. During construction, maintain as-built red-line drawings for all drawings and final as-builts for contractor-generated coordination drawings. Update after completion of Cx (excluding deferred testing).
 20. Provide Training Plan and training of the Owner's operating staff using expert qualified personnel, as specified. Use the draft O&M manual as the training manual.
 21. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
 22. Attend Cx coordination meetings and provided assistance and cooperate in the preparation of a Cx schedule with the GC and CxA.
 23. Cx Tasks shall be performed by the same personnel who were involved in the installation and are familiar with the equipment.
 24. During the Warranty Period execute seasonal or deferred functional performance testing, witnessed by the CxA, according to the specifications and correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
- F. The Cx responsibilities applicable to the TAB Contractor in addition to those which apply in (A) are as follows:
1. Prior to starting TAB, submit to the GC the qualifications of the site technician for the project as required by division 23 specifications. The owner, EOR and/or CxA will approve the site technician's qualifications for this project (if TAB is provided by the GC or subcontractor).
 2. Meet with the CxA and GC and submit the outline of the TAB plan and approach for each system and component to the CxA, GC and the controls contractor prior to starting TAB. The submitted plan will include:
 - a. Certification that the TAB contractor understands the Cx requirements.

- b. An explanation of the intended use of the building control system for TAB. The controls contractor will comment on feasibility of the plan.
 - c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced.
 - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - e. Final test report forms to be used.
 - f. Procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.
 - g. Details of how *total* flow will be determined
 - h. The identification and types of measurement instruments to be used and their most recent calibration date.
 - i. Specific procedures that will ensure that water systems are operating at the lowest possible pressures and provide methods to verify this.
 - j. Details regarding specified deferred or seasonal TAB work.
 - k. Details of any specified false loading of systems to complete TAB work.
 - l. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
- 3. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CxA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.
 - 4. Provide the CxA with any requested data, gathered, but not shown on the draft reports.
 - 5. Provide a final TAB report for the CxA with details, as in the draft.

1.7 RESPONSIBILITY OF THE THIRD-PARTY COMMISSIONING AUTHORITY

- A. Organize and lead the Cx team.
- B. Prepare a construction-phase Cx plan. Collaborate with Contractors and with subContractors to develop test and verification procedures. Include design changes and

scheduled Cx activities coordinated with overall Project schedule. Identify Cx team member responsibilities, by name, firm, and trade specialty, for performance of each Cx task.

- C. Review and comment on submittals from Contractors for compliance with the OPR, BOD, Contract Documents, and construction-phase Cx plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BOD.
- D. Convene Cx team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the Cx processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to Cx team members and attendees within five workdays of the Cx meeting.
- E. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the Cx activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.
- F. Observe and verify construction and report progress and deficiencies. In addition to compliance with the OPR, BOD, and Contract Documents, verify systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
- G. Prepare project-specific test and verification procedures and checklists.
- H. Schedule, direct, witness, and document tests and verifications.
- I. Compile test data, verification reports, and certificates and include them in the systems manual and Cx report.
- J. Develop custom pre-functional and functional testing protocol for review by interested parties.
- K. Perform functional testing with assistance by appropriate contractors.
- L. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
- M. Review project record documents for accuracy. Request revisions from Contractor to achieve accuracy. Project record documents requirements are specified in Division 1.
- N. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BOD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 1.
- O. Review operation and maintenance training program and provide assessment and feedback on the completeness of the maintenance training program requirements. Operation and maintenance training is specified in Division 1.

- P. Assemble the final Cx documentation, including the Cx report and Project Record Documents.

1.8 SYSTEMS TO BE COMMISSIONED

A. HVAC System

1. Packaged Water Chillers and Controls
2. Boilers and Staging Controls
3. Hydronic Pumps.
4. Local and DDC based controls
5. Installation Quality
6. Overall HVAC Functionality

- B. No Functional Testing shall commence until all Prefunctional Checklists are completed and returned to the CxA.

1.9 RECORD DRAWINGS

- A. Record drawings shall be kept on the job site and up dated continuously by the Contractor as the work progresses
- B. Record drawings shall show exact locations and sizes of all the work to be concealed. Especially note the location of the valves, volume dampers, fire dampers, etc.
- C. Non-availability of the updated record drawings or inaccuracies therein shall be grounds for cancellation and/or postponement of any final verification by the Engineer.

1.9 COMMISSIONING APPROACH

A. General

1. The commissioning approach shall include a series of checks, tests, and operational procedures, applied in specific sequences, to each system or equipment component to be commissioned.
2. The contractor shall perform startup tests in accordance with manufacturer's requirements and pre-functional testing in accordance with Commissioning Authority supplied checklists utilizing members of the construction staff and representatives of the equipment and system manufacturers who are fully knowledgeable of the equipment and systems installation and operation.
3. The HVAC contractor is required to fill out the pre-functional testing forms provided by the Commissioning Agent. The Commissioning agent may observe certain pre-functional tests and their discretion.
4. The specific commissioning procedures required are described in the Project Commissioning plan found in section 01 91 14 . These procedures shall be performed in a specific sequence as described in the Project Commissioning Plan. The

sequenced application of the procedures is intended to provide a step-wise development, proceeding from the individual component level, to the system level, and ultimately to the multiple integrated level of system operation. This sequencing approach will require certain procedures to be performed earlier in the construction process than for non-commissioned construction, and is intended to help ensure that the installation is free of defects at the earliest opportunity, allowing increased time for correction or modification if defects or performance issues are found.

PART 2 - PRODUCTS

2.1 Test Equipment

- A. Each subcontractor shall furnish all the equipment and labor to perform the systems and equipment installed under their section. For example, the mechanical and electrical Contractors shall ultimately be responsible for all standard testing equipment for the mechanical, lighting and power systems, controls systems, plumbing systems except for equipment specific to and used by TAB in their Cx responsibilities.
- B. Stand-alone datalogging equipment shall be provided by the CxA as needed.
- C. BMS/DDC tied datalogging equipment and software can be used for Cx at the discretion of the CxA and shall be considered the property of the Owner.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available where applicable.
- E. Refer to the Cx Plan for details regarding equipment that may be required to simulate required test conditions.

PART 3 - EXECUTION

3.1 SUBMITTALS

- A. Contractors shall provide submittal documentation for systems to be commissioned indicated herein and in the Cx Plan.
- B. Mechanical contractor shall provide documentation that includes results of static testing as required by all Division 23 specifications.
- C. Mechanical Contractor shall provide all manufacturer based pre-startup, startup and other equipment specific pre-testing documentation.
- D. Mechanical Contractor shall perform pre-functional testing and provide populated prefunctional checklists to the CxA (Blank forms to be provided by CxA).

3.2 PRE-COMMISSIONING WORK SESSION & KICKOFF MEETING

- A. The mechanical subcontractor shall participate in the pre-commissioning work session to review the CxA's developing Commissioning Plan. The work session shall be held prior to Lighting rough-in.

- B. The work session shall be held at the Contractor's principle place of business or at the job site. The GC, CxA, appropriate subcontractors and representatives of the owner shall be scheduled for attendance as a minimum. Sub-contractor representatives of the principle trades involved in the commissioning process should also be in attendance and may be scheduled for attendance at the discretion of the CxM.
- C. The GC shall record participant comments and distribute minutes of the meeting to all parties involved.
- D. The GC shall schedule and chair a commissioning kickoff meeting review the CxA's testing protocols, revisit the commissioning plan and review scheduling for upcoming testing. The work session shall be prior to startup of major equipment.
- E. The GC shall schedule and the appropriate subcontractors shall participate in the kickoff meeting held separately from the work session.
- F. Mechanical contractor(s) shall participate in both the work session and kickoff meeting.

3.3 STARTUP

- A. The HVAC contractor(s) shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in the Cx Plan. Division 23 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents and manufacturer requirements. The Cx procedures and pre-functional and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the CxA, GC or Owner.

3.4 CONTROLS TESTING PREPARATION AND VERIFICATION

- A. The Cx responsibilities of the Controls Subcontractor in preparation for Functional Testing are:
 - 1. Sequences of Operation Submittals: The Controls Contractor shall send to the CxA complete controls submittals. Submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. See Division 1 for complete details.
 - 2. Points List: The Controls Contractor shall send to the CxA a draft points list as soon as it is available but no later than two months prior to occupancy. This shall be updated as often as required. A complete "as-built" points list shall be sent at the end of the project. See Division 1 for complete required contents of the points list.
 - 3. Point-To-Point Checks – The Controls Contractor is required to perform their own point-to-point checks and provide verification to the CxA prior to the HVAC contractor scheduling functional testing.
 - 4. Notification of Operation: The Controls Contractor shall notify the CxA when each piece of equipment, panel or sub-panel is under automatic control and may be viewed in operation, prior to final functional testing.

5. The Controls Contractor shall review all CxA provided functional test procedures. The receipt of the procedures by the contractor constitutes certification that the contractor has reviewed the procedures and confirmed they are safe and will not harm any equipment or systems. Any subsequent damage incurred as a result of conducting the documented verification shall be the responsibility of the contractor.

3.5 TAB

- A. Refer to the TAB responsibilities above and in the TAB specification section.

3.6 PRE-FUNCTIONAL TESTING

- A. Prior to the beginning of the commissioning and testing specified under this section, the HVAC subcontractor adjust and check operation and performance of the systems and equipment installed under their respective sections.
- B. At the discretion of the CxA the sub systems may be required to be tested prior completion of the entire system.
- C. Provide populated forms to the CxA in submittal form.
- D. Without limiting the following work shall be performed:
 1. Verify and document that the systems and equipment are installed and functioning in accordance with the OPR and contract documents. The as-built drawings and operating manuals reflect the as built conditions.
 2. The systems shall be started and their performance shall be checked and compared with the manufacturers requirements as well as design documents.
 3. Blank Pre-functional checklists shall be provided by the CxA.
 4. Any system or equipment which is does not pass manufacturer startup requirements and Pre-functional testing shall be repaired and replaced at no cost to the owner. The contractor shall retest the system at their own cost until the manufacturers startup requirements and pre-functional testing criteria are met.

3.7 FUNCTIONAL TESTING

- A. After review and acceptance of the manufacturer startup forms and pre-functional checklists, the CxA will schedule dates to begin functional testing.
- B. Functional testing is intended to begin upon completion of a system installation, startup and pre-functional testing. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CxA and Owner. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including all PFTs as soon as possible.
- C. Procedure Acceptance
 1. On-Site Conditional Acceptance

2. Upon satisfactory completion of each commissioning procedure and completion of the procedure close-out meeting, the CxA shall provide conditional acceptance of the procedure.
 3. Conditional acceptance shall indicate that the related installation work checked by the procedure and the related performance verified by the procedure is satisfactory, and that the required procedure has been completed, only.
 4. Conditional acceptance shall not imply that the equipment and systems involved with the procedure are fully approved and have been provided with final acceptance. Conditional acceptance shall additionally be subject to all notes and comments included in the field notes or test forms, and subject to the satisfactory demonstration that all associated pre-testing, special testing, special testing reports, or alignment reports have been fully completed.
 5. Conditional acceptance shall be indicated by the signature of the CxA on the functional testing form.
 6. At the completion of completion of testing, a conditional acceptance memo will be provided to the project team. Conditional acceptance suggests that the majority, if not all, testing has been completed and systems are largely functional and ready to support occupancy. This conditional acceptance memo will be attached to the most current issues log.
- D. On-Site Procedure Rejection
1. The CxA shall have the authority to reject a procedure in its entirety or to cause the procedure to be stopped if in the opinion of the CxA, any of the following conditions exist:
 - a. The pre-procedure review meeting is incomplete.
 - b. Appropriate or sufficient contractor staff is not available or required commissioning representatives are not present.
 - c. Required pre-testing or report data, such as point-to-point control verifications, alignment reports, and trend log data is not available or is incomplete.
 - d. The installation is insufficient or incomplete as required for the procedure or not in compliance with the Contract Documents.
 - e. Numerous checks or tests fail or cannot be accomplished.
 - f. Installation and/or operation of equipment or systems beyond or in advance of the commissioning requirements.
 - g. Installation, operation, or commissioning not in compliance with the sequencing requirements.
 - h. Indication of improper maintenance or operation.
 - i. Inadequate instrumentation

2. The CxA shall additionally reject a procedure and require the equipment operation or procedure to be stopped if in the opinion of the CxA unsafe conditions to either staff or equipment exist. Consideration of safety issues by the CxA shall not in any way relieve the Contractor from his sole responsibility for job site safety and protection of the equipment.
3. Direction to stop the procedure or halt the operation of equipment will be given verbally. Upon notification the Contractor shall immediately stop the procedure and restore the system or equipment to a safe condition.
4. At the discretion of the CxA, the Contractor may be afforded the opportunity to correct the conditions indicated by the CxA and resume the procedure.
5. If in the opinion of the CxA corrections cannot be implemented in a satisfactory manner, within the scheduled time available for the procedure and with sufficient time available to complete the procedure, the procedure shall be stopped and re-scheduled by the CxM. The CxA shall provide the CxM with written notification of procedure rejection stating the cause of the action.
6. The Contractor shall be liable for all actual costs associated with the required attendance by the CxA, the Owner's and A/E's commissioning representatives, and required outside agents, resulting from rejected procedure.
7. Actual costs shall include:
 - a. Cost for the CxA and for each Owner's and A/E's commissioning representative, which are comprised of contractual billing rate as defined in the respective organization's agreement for such work, including overhead and profit. For CxA and A/E's commissioning representatives, these rates may be found in the A/E schedule for additional services.
 - b. Travel-related expenses for the CxA and for each Owner's or A/E's commissioning representative, where such staff is required to be in attendance and not headquartered within the city limits, which are comprised of compensation for actual travel time, with an established minimum of 5 hours, and mileage rates, billed at the prevailing national government rate.
 - c. Costs assessed for required outside agents, contractors, or specialists employed by the Owner or A/E at the actual contractual billing rates as defined in the respective organization's agreement for such work.
 - d. Equipment rentals, special tools, and related material fees associated with the participation of contracted outside organizations and specialists.
8. The costs assessed will be documented by the CxA and will be deducted from the Contractor's fees or progress payments at the time of occurrence.

3.8 FINAL ACCEPTANCE

- A. Final acceptance will be contingent upon satisfactory completion of all commissioning tasks and submittals, with final review and approval by the Commissioning Authority.

- B. Where specific components, equipment, or system elements are unable to comply with the specified requirements due to improper or incomplete installation, product defect, or failure of a device to perform to the manufacturer's published or advertised capabilities, final acceptance will be contingent on repair, replacement, and correction of the deficiencies by the Contractor and satisfactory completion of the commissioning procedures.
- C. Where specific components, equipment, or system elements are demonstrated to comply with the specified requirements and perform to the manufacturer's published or advertised capabilities, but are demonstrated not to provide the performance as required by the Contract Documents and the commissioning procedures, disposition of the issue and/or related modifications shall be provided as directed by the Architect. Final acceptance shall be contingent on the completion of any resulting correction work and related commissioning requirements determined as necessary in final disposition of the issue.
- D. Upon satisfactory completion of all commissioning work and resolution of all related issues, the CxA shall provide the Owner, Contractor, and the Architect with a final report documenting recommendation for final acceptance. Recommendation for final acceptance by the CxA shall indicate that in the opinion of the CxA, and as demonstrated within the extent and scope of the commissioning process, the equipment and systems have been installed in compliance with, and function as required by the Contract Documents.
- E. The Owner may accept the recommendation of the CxA and provide final acceptance by providing the appropriate authorized signature and by providing copies of the signed acceptance to all parties involved. The Owner's final acceptance of the commissioning work shall indicate that Owner accepts that the systems and equipment, as demonstrated within the extent and scope of the commissioning process, have been installed in compliance with, and function as required by, the Contract Documents. The Owner's acceptance shall not constitute agreement that all contractual obligations are fulfilled and does not constitute final acceptance of the project under the terms and conditions of the Contract Documents.

END OF SECTION 230800

SECTION 230900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 EXISTING

- A. The existing DDC infrastructure consists of a Automated Logic Corp. G5CE BACNet Router sending BACNet/IP to the owners network, with an Arcnet buss and BACNet MS/TP communication for some equipment.

1.2 SCOPE OF WORK

- A. The new control infrastructure must include new Automated Logic brand field controllers to be connected to the existing Automated Logic DDC system. All new points shall be mapped directly into the existing DDC system, no integration allowed. The new heating and cooling controls will be connected to the existing control infrastructure. In its final configuration, the new control infrastructure and the existing control infrastructure will communicate via BACNet MS/TP and all new and old objects will be visible and adjustable at the existing operator workstation. Any recommended variations of this scope must be coordinated with the EOR.
- B. Prior to bidding and finalizing the pricing for this project, the Facility Management and Control System (FMCS) contractor shall review existing Metasys infrastructure for component and Direct Digital Control (DDC) infrastructure reuse. The as-operating system shall be evaluated for compatibility with new equipment and current design requirements. A complete replacement of the DDC infrastructure is not anticipated and the existing equipment is expected to be reused. Components and general infrastructure that is considered unreasonably outdated for the new application shall be replaced. Coordinate this evaluation with the Engineer of Record, and ISU Facilities M&O.
- C. The FMCS Contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified.
- D. The system shall only employ BACnet communications in an open architecture with the capabilities to support a multi-vendor environment. The system shall be capable of integrating third party systems and utilizing the following standard protocols.
 - 1. BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2004.
 - 2. OPC server communications according to OPC Data Access 2.0 and Alarms and Events 1.0.
- E. The FMCS shall be web based and shall provide total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.
- F. All materials and equipment used shall be standard components, regularly manufactured

with standard part numbers and owner's manuals for this system.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.

1.4 QUALITY ASSURANCE

- A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.
- B. All FMCS Application Specific Controllers and Programmable Equipment Controllers shall be listed as follows:
 - 1. Underwriters Laboratory, UL 916
 - 2. FCC Regulation, Part 15, Class B

1.5 SUBMITTALS

- A. Submit 6 complete sets of documentation in the following phased delivery schedule:
 - 1. Controller schedules
 - 2. Equipment data cut sheets
 - 3. System schematics, including:
 - a. sequence of operations
 - b. point names
 - c. point addresses
 - d. point to point wiring
 - e. interface wiring diagrams
 - f. panel layouts
 - g. system riser diagrams
 - 4. AutoCAD compatible as-built drawings.
- B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
 - 1. Index sheet, listing contents in alphabetical order
 - 2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
 - 3. Description of sequence of operations
 - 4. As-Built interconnection wiring diagrams
 - 5. Trunk cable schematic showing remote electronic panel locations, and all trunk data
 - 6. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
 - 7. Copy of the warranty/guarantee
 - 8. Operating and maintenance instructions

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND CONTRACTORS

A. Automated Logic Corp. by Clima-Tech

1. Contact: Randy Gathagan, 504 N. Phillippi Street, Boise, Idaho 83706; 208-377-9755, randy.gathagan@clima-tech.com

2.2 The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers. The FMCS shall incorporate BACnet MSTP485 or Ethernet in all unitary, terminal and other device controllers. The system shall include:

- A. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions. System shall use the latest controller.
 1. The PEC's shall communicate via BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2004.
 - a. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.
 - b. Provide programming, engineering, and configuration tools used for the project duly licensed to the owner for owner's use.
 - c. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
 - d. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.
 - e. Each PEC shall support firmware upgrades without the need to replace hardware.
 - f. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.
 - g. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - h. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
 - i. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, and downtime and re-load time.
 - j. Provide a separate PEC for each AHU or other HVAC system such that the inputs, calculations, and outputs shall reside on a single controller.
 - k. Existing Sequence of Operation shall be translated as required to the new controllers. No additional charges shall be accepted or approved for failure to understand the required work to move the existing sequences to the new controllers.

1. New Sequence of Operation shall replace existing Sequence of Operation where indicated on mechanical drawings. Reference M003.

1.1 Cyber Health Dashboard

1. The Mobile User Interface shall provide a dedicated dashboard display that informs and educates system administrators of relevant and critical user account and system information related to the cybersecurity health of the IAS. The Cyber Health Dashboard will use screen scalable reporting “widget” areas: a User Activity widget, a Security Analysis widget, and a System Status widget.
2. The User Activity widget will contain a graphical bar chart that will show successful log-in (blue bar), unsuccessful log-in (light blue bar) and locked out accounts (red bar) along with date and time of log-in event. The color-coded bar graphic will provide an easy way to view anomalies and high volume of successful or unsuccessful log-in attempts. User will be able to select from a historical database to see past data on successful, unsuccessful log-in attempts and locked out accounts.
3. The Security Analysis widget will show critical issues related to IAS accounts, including:
 - a. User accounts that are set to never keep password history (ability to re-use last 11 passwords)
 - b. User accounts that have passwords that never expire
 - c. User accounts are set to never lock out
 - d. User accounts with inactive session set to never terminate
4. The Security Analysis widget will show potential risks related to IAS accounts, including:
 - a. User accounts that are set to never check for user account dormancy
 - b. User accounts with inactive sessions greater than 30 minutes
 - c. Dormant user accounts
 - d. Temporary user accounts
5. The Security Analysis widget will show informational data related to IAS accounts, including:
 - a. Total number of existing IAS user accounts
 - b. Total number of active IAS user accounts
 - c. Total number of accounts with standard access, total number of accounts with administrator role, total number of accounts with basic access
 - d. Total number of disabled user accounts
6. A link to best practice policy recommendations will be available beside each user account analysis mentioned in I. sections 1 to 5 mentioned above.
7. The System Status widget will show an account overview and a supervisory engine overview.
 - a. The Account overview will show total IAS user accounts with a count of active, disabled and admin user accounts.
 - b. The Engine overview will show number of supervisory devices and how many are online and offline

- c. An Engine detail tab will show supervisory controller name, IP address, certificate expiration, software version and status

B. Dashboard Displays

1. The Mobile User Interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.
2. Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:
 - a. Equipment Serving Space
 - b. Potential Problem Areas
 - c. Equipment Summary
 - d. Graphic Display (if specified)
 - e. Schedule
3. Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:
 - a. Trend
 - b. Equipment Activity Summary
 - c. Equipment Relationships Summary
 - d. Equipment Data
 - e. Graphic Display (if specified)
 - f. Schedule
4. Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
5. Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.
6. Default dashboard displays by space and equipment type shall be created per the guidelines in this specification or by mutual agreement with the owner's representative.

C. The Mobile User Interface shall include automatically populated dedicated, interactive summaries which provide detailed information on specific IAS data, including:

1. Potential problem areas, based on communication faults, overrides, deviations from setpoints, and/or alarm conditions
 - a. The Mobile User Interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
 - b. The information shall include:
 - c. Point status (via color.)

- d. Point name.
- e. Value of the point when the summary was taken.
- f. Equipment that contains the offending point.
- g. Space that is served by that equipment.
- h. Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
- i. The summary may be exported in .csv format for inclusion in spreadsheets or other documents.

2. IAS Historical Trend Data

- a. IAS historical trend data and graphical representations with the most relevant points displayed initially and the ability for the Operator to select and deselect points to add and remove from the trend
- b. The Mobile User Interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
- c. The user shall have the ability to navigate to a selection list of frequently viewed trends.
- d. Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
- e. Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.

3. Equipment Activity Summary

- a. The Mobile User Interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.
- b. Items shall be listed in timed order with the latest activity at the top of the list.
- c. Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
- d. It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
- e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
- f. Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.

4. Equipment Relationship Summary

- a. The Mobile User Interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing
- b. Include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.

5. Equipment Data Summary
 - a. The Mobile User Interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format.
 - b. Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
 - c. It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.
6. Equipment Serving Space Summary
 - a. The Mobile User Interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
 - b. The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.
 - c. Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
 - d. It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
 - e. It shall be possible to display specific systems and points by filtering equipment types desired.
7. Graphical Displays
 - a. The Mobile User Interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.
 - b. Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
 - c. Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.
 - d. It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.
8. Scheduling
 - a. The Mobile User Interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.
 - b. The Mobile User Interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing

individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.

- c. The Mobile User Interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

D. Graphics development and management tool

1. An integral graphic manager shall be provided including the following features and capabilities:
2. Creation and modification of graphics from any HTML5 capable browser without the need for additional plug-ins or software packages.
3. Access to a full suite of pre-defined templates for air and water sourced HVAC applications as well as the ability to add custom templates as created for other use. Pre-aliased graphic templates may be defined and saved for repetitive representations of common mechanical and electrical equipment.
4. A full suite of pre-defined 3D-like symbols for mechanical and electrical systems as well as all line, text and shape tools required for integration into a graphic with zoom and pan capabilities on multiple platforms and in multiple browsers.
5. The ability to search and replace items in multiple graphics with a single command.
6. The ability to import and insert photos and images into the graphic.
7. The ability of the graphics manager to create and edit graphics including the ability to bind graphic elements to the values and conditions of system points in both an on-line and off-line mode.

E. Alarm Management

1. The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
2. The user interface shall provide notification of new alarms, visually and audibly.
3. The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.
4. The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.
5. The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
6. The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
7. The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.

8. The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enable or disable the 24/7 alarm monitor mode if desired.

F. Alarm Escalation

1. The Mobile User Interface will provide a configurable alarm escalation path for specific alarm occurrences related to equipment or space providing a way to reduce the risk of a user missing critical alarms. If an alarm has not been acknowledged or discarded by recipients within a specified period of time, an additional set of recipients can be notified. Additional notification will be available through email, printer, SNMP or Syslog. Text messaging can be achieved by entering recipients 10 digit cellular phone number formatted as a standard email address (10digit phone number @ cellular carrier's gateway domain)
2. For email notification, the alarm notification can be configured to send the alarm condition out to user defined email address(es). If the alarm has not been acknowledged/discarded after a user defined length of time (in hours/minutes), additional escalation of the alarm will be sent out to additional user defined email address(es)
3. User can filter for alarms tied to specific pieces of equipment / spaces to enable alarm escalation notifications related to overall systems and space.
4. A test email feature will also allow the system to send out a test email to confirm that the remote notifications are configured properly and that recipients are able to receive them, preventing missed notifications due to misconfiguration.

G. Operator Access Configuration

1. The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.
2. The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.

H. User Interface Security/Passwords

1. Based on owner-configurable access and permissions, the user interface should provide the ability to perform the actions described below via Internet browser from any authorized device connected to the ISU Campus infrastructure to which the network controllers are also connected.
2. Multiple-level passwords access protection shall be provided via roles and permissions defined by the ISU Facilities management. This feature will allow access to the system based a user's job title or role and allow the user/manager the ability to control, display, and database manipulation capabilities based on an assigned password.
3. Roles may be copied and altered to meet specific roles and permissions based on the particular policies.
4. Each user shall have the following: a user account name (with a maximum of 30 characters), a complex password or passphrase (with a min of 8 characters and a max of 50

characters), other user account policies (such as session timeout), timesheet access based on day of the week and time of day, and specific user view.

5. The system shall allow each user to change his or her password at will.
6. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
7. A maximum of 150 categories may be used to determine or assign areas of responsibilities to each user account. A maximum of 13 (of the 150) named categories which are specifics such as “No Access, View, Advanced Review, Operate, Intervene, Diagnostic, Manage Item Events, Manage Every, and Configure Items”.
8. A minimum of 100 unique passwords shall be supported.
9. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
10. Operators shall be further limited to only access, command, and modify those buildings, systems, and subsystems for which they have responsibility. Provide a minimum of 100 categories of systems to which individual operators may be assigned.
11. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
12. After successful login to the Site Management Portal (SMP) the last time and date that user name was previously logged in is shown on the screen.
13. Each login attempt is recorded in the system Audit Log with the option to record the IP address of the PC that made the login.

1.2 INSTRUMENTATION

A. GAUGES, PRESSURE AND COMPOUND, PIPE OR TANK-MOUNTED

1. Construction:
 - a. Case: Solid armored front between measuring element and dial, blowout back, bottom connection, phenol turret type.
 - b. Dial: Non-corrosive, 115 mm (4-1/2 inch) diameter face with black markings on white background.
 - c. Measuring Element: Bourdon tube designed for the required service. Provide bellows designed for service for pressure ranges less than 103 kPa (15 psig).
 - d. Movement: Stainless steel, rotary.
 - e. Pointer: Micrometer adjustable, black color.
 - f. Window: Plastic.
 - g. Liquid Filled Gauges: Provide at inlet and outlet of all pumps, on compressed air systems, and on fuel and atomizing media lines at locations closest to burners where bourdon tube gauges are utilized. Gauge filling shall be glycerin or silicone oil. Purpose of filling is to provide pulsation dampening. As an option to liquid filling, provide dry gauges that have built-in fluid clutch dampeners that are not vulnerable to plugging due to foreign material.

2. Accuracy: ASME B40.100, Grade 2A, 1/2 percent, on all gauges; except Grade A, one percent permitted on diaphragm actuated gauges, liquid-filled gauges, and compound gauges.
 3. Accessories:
 - a. Red set hands on gauges located at automatic pressure regulator valve outlets.
 - b. Needle valve or gauge cock rated for the service.
 - c. Syphon on all steam gauges.
 - d. Pulsation snubbers on diaphragm-type gauges located adjacent to gas burners.
 4. Scale Ranges: Provide English scales:
 - a. Natural gas: 0 to 10 psig.
 - b. Gas burner, 125 percent of full load pressure, inches WG.
 - c. Pumps: 0 to 100 psig.
 - d. Other services, 200 percent of maximum operating pressure.
- B. THERMOMETERS, PIPE OR TANK-MOUNTED
1. General: Thermometer locations are shown in the contract documents.
 2. Construction:
 - a. Industrial type, separable well and socket, union connected.
 - b. Scales: Red reading mercury combination. Scale length 9 inch. Mercury sealed under pressure with inert gas to prevent oxidation and separation of column.
 - 1) 30 to 240 degrees Fahrenheit scales for heating applications.
 - 2) 0 to 100 degrees Fahrenheit scales for chilled water applications.
 - c. Case: Corrosion resistant with glass or plastic front.
 - d. Form: Straight or back form except thermometers located greater than 7 feet above floor or platform shall be adjustable angle.
 - e. Wells: Sized to suit pipe diameter without restricting flow. Provide snug sliding fit between socket and well.
 - f. Accuracy: One percent of scale range.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

- A. Provide a project manager who shall, as a part of his duties, be responsible for the following activities:
1. Coordination between the Controls Contractor and all other trades, Owner, local authorities and the design team.
 2. Scheduling of manpower, material delivery, equipment installation and checkout.
 3. Maintenance of construction records such as project scheduling and manpower planning and AutoCAD or Visio for project co-ordination and as-built drawings.
 4. Coordination/Single point of contact

3.2 INSTALLATION METHODS

- A. Prior to work beginning the Controls Contractor shall provide the Owner with a pre-installation Performance Verification of the existing system.

1. Performance Verification (PV)
 - m. The PV shall include:
 - 1) A complete and current Building Automation System site inventory including the following information at a minimum: a listing of all field and supervisory controllers with the following key attribute data; corresponding model numbers, firmware versions, available security updates, CPU and memory performance data, battery conditions, integrations, controlled equipment, and device and point counts.
 - 2) A complete, written evaluation of system configuration and performance in the following categories: Security, Energy Performance and Savings, Reliability, Comfort and Health, and Standards.
 - 3) The Security evaluation shall include information about controllers that require security updates and conformance of user accounts to latest security rules and best practices
 - 4) The Energy Performance and Savings evaluation shall identify opportunities through schedule and nightly setbacks, economizers, eliminating simultaneous heating and cooling, and adding variable speed drives to equipment.
 - 5) The Comfort and Health evaluation shall identify temperature, pressure, and carbon dioxide values that deviate from desired set points that could lead to occupant discomfort.
 - 6) The Reliability evaluation shall identify overridden control points, control points creating excessive alarms, and opportunities to adding control points and trends to further enable system functionality.
 - 7) The Standards evaluation shall identify conformance to published standards for point count, network performance and protocol standards
- B. Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division-26 sections of these specifications.
- C. The term "control wiring" is defined to include providing of wire, conduit, and miscellaneous materials as required for mounting and connecting electric or electronic control devices.
- D. To run BACnet on the Ethernet network, the installer is required to run, at minimum, plenum rated CAT 5e cabling for all runs associated with this network.
- E. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in Division 26 specification.
- F. All Controllers, required for stand-alone control shall be housed in a NEMA 1 enclosure with a lockable door.

3.3 INSTALLATION

- A. The Vendor shall program all systems at the time of installation with logical relations to spaces, locations, and related equipment
- B. The Vendor shall program these relations, names, tags, and descriptions from inception, such that the MUI navigation and search shall be automatically generated and populated
- C. Create a point sampling trend to archive the real-time value or status of a point or object. View the trended value or status of a point or object over a time interval; create an automated report to email a configured data trend to a specific email address at a specific time/day.

3.4 FIELD QUALITY CONTROL

- A. Verification
 - 1. Including but not limited to, graphics, links, references, addresses, and configurations are installed prior to project completion
- B. Verify that all Operator controllable MUI elements are clearly identified as such, and are suitably responsive
- C. Verify that all data is displayed with correct units
- D. Verify all navigability

3.5 SYSTEM ACCEPTANCE

- A. General: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner's Commissioning Authority. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at Substantial Completion.
- B. Field Equipment Test Procedures: DDC control panels shall be demonstrated via a functional end to end test. Such that:
 - 1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
 - 2. All analog input channels shall be verified for proper operation.
 - 3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.
 - 4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
 - 5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.
 - 6. Selected time and setpoint schedules shall be verified by changing the schedule and

observing the correct response on the controlled outputs.

- C. As-Built Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "6" complete as-built drawing sets, together with AutoCAD or Visio diskettes to the owner.
- D. Operation and Maintenance Manuals: Submit four copies of operation and maintenance manuals. Include the following
 - 1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals, and any miscellaneous components used in the system.
 - 2. An operator's manual that will include detailed instructions for all operations of the system.
 - 3. An operator's reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.
 - 4. A copy of the warranty/guarantee.
 - 5. Operating and maintenance cautions and instructions.
- E. Prior to training, the Controls Contractor shall provide the Owner with a post-installation Performance Verification of the existing system. The pre- and post-installation Performance Verifications shall be reviewed during the training.
 - 1. Performance Verification (PV) as required for demonstration of functionality by the Owner's Commissioning Authority.
 - 2. In-house PV shall be conducted prior to demonstration to Owner's Commissioning Authority.

3.6 TRAINING

- A. Contractor shall provide to the engineer a training class outline prior to any scheduled training.
- B. Factory trained control engineers and technicians shall provide training sessions for the Owner's personnel.
- C. The control contractor shall conduct one (1) four-hour training for the designated owner's personnel in the maintenance and operation of the control system.
- D. The training shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
 - 1. HVAC system overview
 - 2. Review of the PV report
 - 3. Operation of Control System

4. Function of each Component
5. System Operating Procedures
6. Programming Procedures
7. Maintenance Procedures

3.7 WARRANTY/GUARANTEE

- A. The control system shall be warranted/guaranteed to be free from defects in both material and workmanship for a **period of two (2) years of normal use and service**. This warranty/guarantee shall become effective the date the owner accepts or receives beneficial use of the system.
- B. After completion this contractor shall make adjustments and modification as necessary for the **two-year warranty period**. During this period the contractor as directed by the engineer shall make modifications and adjustments to the building systems at no additional cost or compensation.

END OF SECTION 230900

SECTION 23 11 23 FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Fuel gas systems, including piping, equipment and all necessary accessories as designated in this section. Fuel gas piping for central boiler plants is included.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

- A. Section 01 33 00, SUBMITTAL PROCEDURES.
- B. Section 23 05 23, GENERAL DUTY VALVES FOR HVAC PIPING.
- C. Section 23 08 00, COMMISSIONING OF HVAC.
- D. Section 23 09 00, INSTRUMENTATION AND CONTROLS FOR HVAC.
- E. Section 23 21 13, HYDRONIC PIPING.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the Idaho State Codes standard will govern.
- B. American Society of Mechanical Engineers (ASME):
 - 1. B16.3-2019 Malleable Iron Threaded Fittings: Classes 150 and 300
 - 2. B16.9-2018 Factory Made Wrought Butt welding Fittings
 - 3. B16.11-2011 Forged Fittings, Socket-Welding and Threaded
 - 4. B16.15-2018 Cast Copper Alloy Threaded Fittings: Classes 125 and 250
 - 5. B16.40-2019 Manually Operated Thermoplastic Gas Shutoffs and Valves in Distribution Systems
 - 6. B31.8-2018 Gas Transmission and Distribution Piping Systems
- C. American Society for Testing and Materials (ASTM):
 - 1. A47/A47M-2018 Standard Specification for Ferritic Malleable Iron Castings
 - 2. A53/A53M-2018 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. A536-2019 Standard Specification for Ductile Iron Castings
 - 4. A733-2016 Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless-Steel Pipe Nipples
 - 5. B43-2015 Standard Specification for Seamless Red Brass Pipe, Standard Sizes
 - 6. B687-2016 Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
- D. International Code Council (ICC):
 - 1. IFGC-2018 International Fuel Gas Code
 - 2. ISPC-2018 Idaho State Plumbing Code
- E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

1. SP-72-2010a Ball Valves with Flanged or Butt-Welding for General Service
 2. SP-110-2010 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- F. NACE International (NACE):
1. SP0274-2011 High-Voltage Electrical Inspection of Pipeline Coatings
 2. SP0490-2007 Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coating of 250 to 760 μm (10 to 30 mil)
- G. National Fire Protection Association (NFPA):
1. 54-2018 National Fuel Gas Code

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES and as noted on the drawings.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 11 23, FACILITY NATURAL-GAS PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Pipe & Fittings.
 2. Valves.
 3. Strainers.
 4. All items listed in Part 2 - Products.
- D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
 2. Include complete diagrams of the internal wiring for each item of equipment.
 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. Completed Pre-Functional Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- G. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, approved substitutions and construction revisions shall be in electronic version on CD or DVD inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting

techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
 - 1. Red-lined, PDF mark-up drawings prepared with a PDF software program are to be provided, with one paper copy and a PDF version of the mark-up drawings provided on CD or DVD.
- D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local requirements.
- E. Certification documentation shall be provided to EOR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

PART 2 - PRODUCTS

2.1 FUEL GAS PIPING ABOVE GROUND

- A. Pipe: Black steel, ASTM A53/A53M, Schedule 40.
- B. Nipples: Steel, ASTM A733, Schedule 40.
- C. Fittings:
 - 1. Sizes 50 mm (2 inch) under ASME B16.3 threaded malleable iron.
 - 2. Over 50 mm (2 inch) and up to 100 mm (4 inch) ASME B16.11 socket welded.
 - 3. Over 100 mm (4 inch) ASME B16.9 butt welded.
- D. Joints: Provide welded or threaded joints.
- E. Threaded Metallic Joints: Threaded joints in metallic pipe shall have tapered threads evenly cut. Metal screwed pipe joints shall be made leak-tight by applying Rector Seal No. 5 pipe thread sealant to all threaded joints. Care must be taken to prevent the pipe dope compound from getting inside the internal pipeline. Teflon tape type sealant is prohibited.

2.2 EXPOSED FUEL GAS PIPING

- A. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified on the drawings.

2.3 VALVES

- A. Ball Valve: Bronze body, rated for 150 psig at 365 degrees F, reinforced TFE seat, stem seal and thrust washer; end entry, threaded ends, UL-listed for natural or LP gas shut off service when used on those services.
- B. Gas Vent Cocks: Type 701: Bronze body, tee handle, rated for 30 psig at 100 degrees F, ground plug, rated for tight shut-off on fuel gas service.

2.4 WATERPROOFING

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
- C. Walls: See detail shown on drawings.

2.5 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.
- C. Body: Smaller than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and larger, cast iron or semi-steel.

2.6 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the ICC IFGC, ICC ISPC and the following:
 - 1. Install branch piping for fuel gas and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, shall be reamed to full size after cutting.
 - 3. All pipe runs shall be laid out to avoid interference with other work.
 - 4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible.
 - 5. Install union and shut-off valve on pressure piping at connections to equipment.
 - 6. Pipe Hangers, Supports and Accessories:
 - a. All piping shall be supported per the ICC IFGC.
 - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
 - c. Floor, Wall and Ceiling Plates, Supports, Hangers:

- 1) Solid or split unplated cast iron, chrome plated in finished areas.
 - 2) All plates shall be provided with set screws.
 - 3) Pipe Hangers: Height adjustable clevis type.
 - 4) Adjustable Floor Rests and Base Flanges: Steel.
 - 5) Concrete Inserts: "Universal" or continuous slotted type.
 - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - 7) Riser Clamps: Malleable iron or steel.
 - 8) Rollers: Cast iron.
 - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
 - 10) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.
7. Install cast chrome plated escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
 8. Penetrations:
 - a. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- B. Fuel gas piping shall conform to the following:
1. Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.
 2. Provide fuel gas piping with plugged drip pockets at low points.
- 3.2 CLEANING OF SYSTEM AFTER INSTALLATION
- A. Clean all piping systems to remove all dirt, coatings and debris. Remove all strainers, controls etc., and reinstall after piping system has been cleaned.
- 3.3 TESTS
- A. General: Test system either in its entirety or in sections after system is installed or cleaned.
- B. Test shall be made in accordance with Section 406 of the International Fuel Gas Code. The system shall be tested at a minimum of 1.5 times maximum working pressure, but not less than 3 psig.
- C. System Purging: After completing pressure tests, and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to NFPA 54 and ASME B31.8.
- 3.4 STARTUP AND TESTING
- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- C. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with EOR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.

3.5 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.

3.6 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 1 hour to instruct each ISU personnel responsible in operation and maintenance of the system.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 231123

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field refrigerant piping for direct expansion HVAC systems.
- B. Refrigerant piping shall be sized, selected, and designed either by the equipment manufacturer or in strict accordance with the manufacturer's published instructions. The schematic piping diagram shall show all accessories such as, stop valves, level indicators, liquid receivers, oil separator, gauges, thermostatic expansion valves, solenoid valves, moisture separators and driers to make a complete installation.
- C. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- D. Definitions:
 - 1. Refrigerating system: Combination of interconnected refrigerant-containing parts constituting one closed refrigeration circuit in which a refrigerant is circulated for the purpose of extracting heat.
 - 2. Low side means the parts of a refrigerating system subjected to evaporator pressure.
 - 3. High side means the parts of a refrigerating system subjected to condenser pressure.
 - 4. Brazed joint: A gas-tight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 449 degrees C (840 degrees F) but less than the melting temperatures of the joined parts.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- C. Section 23 07 11, HVAC, and BOILER PLANT INSULATION.
- D. Section 23 21 13, HYDRONIC PIPING.
- E. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
- B. Air Conditioning, Heating, and Refrigeration Institute (ARI/AHRI):
 - 495-2005 Standard for Refrigerant Liquid Receivers
 - 730-2013 Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers
 - 750-2016 Thermostatic Refrigerant Expansion Valves

- 760-2014 Performance Rating of Solenoid Valves for Use with Volatile Refrigerants
- C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
15-2019 Safety Standard for Refrigeration Systems (ANSI)
17-2015 Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (ANSI)
63.2-2017 Method of Testing Liquid Line Filter Drier Filtration Capability (ANSI)
- D. American National Standards Institute (ANSI):
A13.1-2020 Scheme for Identification of Piping Systems
Z535.1-2017 Safety Color Code
- E. American Society of Mechanical Engineers (ASME):
B16.22-2018 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ANSI)
B16.24-20016 Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500 (ANSI)
B31.5-2019 Refrigeration Piping and Heat Transfer Components (ANSI)
B40.100-2013 Pressure Gauges and Gauge Attachments
B40.200-2008 Thermometers, Direct Reading and Remote Reading
- F. American Society for Testing and Materials (ASTM)
A126-2014 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
B32-2020 Standard Specification for Solder Metal
B88-2020 Standard Specification for Seamless Copper Water Tube
B88M-2020 Standard Specification for Seamless Copper Water Tube (Metric)
B280-2020 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- G. American Welding Society, Inc. (AWS): Brazing Handbook
A5.8/A5.8M-2019 Standard Specification for Filler Metals for Brazing and Braze Welding
- H. Underwriters Laboratories (UL):
207-2009 Standard for Refrigerant-Containing Components and Accessories, Nonelectrical

429-2013 Standard for Electrically Operated Valves

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 23 00, REFRIGERANT PIPING", with applicable paragraph identification.
- C. Shop Drawings:
 - 1. Complete information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with in the contract documents for components noted below:
 - a Tubing and fittings
 - b Valves
 - c Strainers
 - d Moisture-liquid indicators
 - e Filter-driers
 - f Flexible metal hose
 - g Liquid-suction interchanges
 - h Oil separators (when specified)
 - i Gauges
 - j Pipe and equipment supports
 - k Refrigerant and oil
 - l Pipe/conduit roof penetration cover
 - m Soldering and brazing materials
 - 2. Layout of refrigerant piping and accessories, including flow capacities, valves locations, and oil traps slopes of horizontal runs, floor/wall penetrations, and equipment connection details.
- D. Certification: Copies of certificates for welding procedure, performance qualification record and list of welders' names and symbols.
- E. Design Manual: Furnish two copies of design manual of refrigerant valves and accessories.

1.5 QUALITY ASSURANCE

- A. Refer to specification Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. The application of this Code is intended to assure the safe design, construction, installation, operation, and inspection of every refrigerating system employing a fluid which normally is vaporized and liquefied in its refrigerating cycle.

- C. Comply with ASME B31.5: Refrigerant Piping and Heat Transfer Components.
- D. Products shall comply with UL 207 "Refrigerant-Containing Components and Accessories, "Nonelectrical"; or UL 429 "Electrical Operated Valves."

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Refrigerant Piping: For piping up to 100 mm (4 inch) use Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer. For piping over 100 mm (4 inch) use A53 Black SML steel.
- B. Water and Drain Piping: Copper water tube, ASTM B88M, Type B or C (ASTM B88, Type M or L). Optional drain piping material: Schedule 80 flame retardant Polypropylene plastic.
- C. Fittings, Valves and Accessories:
 - 1. Copper fittings: Wrought copper fittings, ASME B16.22.
 - a Brazed Joints, refrigerant tubing: Cadmium free, AWS A5.8/A5.8M, 45 percent silver brazing alloy, Class BAg-5.
 - b Solder Joints, water and drain: 95-5 tin-antimony, ASTM B32 (95TA).
 - 2. Steel fittings: ASTM wrought steel fittings.
 - a Refrigerant piping – Welded Joints.
 - 3. Flanges and flanged fittings: ASME B16.24.
 - 4. Refrigeration Valves:
 - a Stop Valves: Brass or bronze alloy, packless, or packed type with gas tight cap, frost proof, back seating.
 - b Pressure Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; UL listed. Forged brass with nonferrous, corrosion resistant internal working parts of high strength, cast iron bodies conforming to ASTM A126, Grade B. Set valves in accordance with ASHRAE Standard 15.
 - c Solenoid Valves: Comply with ARI 760 and UL 429, UL-listed, two-position, direct acting or pilot-operated, moisture and vapor-proof type of corrosion resisting materials, designed for intended service, and solder-end connections. Fitted with suitable NEMA 250 enclosure of type required by location and closed holding coil.
 - d Thermostatic Expansion Valves: Comply with ARI 750. Brass body with stainless-steel or non-corrosive nonferrous internal parts, diaphragm and spring-loaded (direct-operated) type with sensing bulb and distributor having side connection for hot-gas bypass and external equalizer. Size and operating

characteristics as recommended by manufacturer of evaporator and factory set for superheat requirements. Solder-end connections. Testing and rating in accordance with ASHRAE Standard 17.

e Electronic Thermostatic Expansion Valves: Electronic thermal expansion valves shall be stepper motor high resolution drive assembly type for precision control. Valve shall not exceed 6 watts max consumption. Compatibility tested with most CFC, HCFC, and HFC refrigerants and oils. Valve pistons and ports to be characterized to provide improved flow resolution and performance. Valves to be interfaced with microprocessor-based controllers by devise manufacturer with temperature feedback loop. Electric expansion valves to be sized with nominal steps of stroke for tonnage application as recommended by valve manufacture ranging from 500 steps on small tonnage (under 5 tons per circuit) to 6300 on large tonnage circuits (over 100 tons per circuit)

f Check Valves: Brass or bronze alloy with swing or lift type, with tight closing resilient seals for silent operation; designed for low pressure drop, and with solder-end connections. Direction of flow shall be legibly and permanently indicated on the valve body.

5. Strainers: Designed to permit removing screen without removing strainer from piping system, and provided with screens 80 to 100 mesh in liquid lines DN 25 (NPS 1) and smaller, 60 mesh in liquid lines greater than DN 25 (NPS 1), and 40 mesh in suction lines. Provide strainers in liquid line serving each thermostatic expansion valve, and in suction line serving each refrigerant compressor not equipped with integral strainer.
6. Refrigerant Moisture/Liquid Indicators: Double-ported type having heavy sight glasses sealed into forged bronze body and incorporating means of indicating refrigerant charge and moisture indication. Provide screwed brass seal caps.
7. Refrigerant Filter-Dryers: UL listed, angle or in-line type, as shown in the contract documents. Conform to ARI Standard 730. Heavy gauge steel shell protected with corrosion-resistant paint; perforated baffle plates to prevent desiccant bypass. Size as recommended by manufacturer for service and capacity of system with connection not less than the line size in which installed. Filter driers with replaceable filters shall be furnished with one spare element of each type and size.
8. Flexible Metal Hose: Seamless bronze corrugated hose, covered with bronze wire braid, with standard copper tube ends. Provide in suction and discharge piping of each compressor.
9. Water Piping Valves and Accessories: Refer to specification Section 23 21 13, HYDRONIC PIPING, Section 23 64 00, PACKAGED WATER CHILLERS and Section 13 21 29, CONSTANT TEMPERATURE ROOM.
10. Oil Separators: Provide for condensing units, as shown. All welded steel construction with capacity to eliminate a minimum of 95 percent of the oil from the hot gas flowing through it. Provide manufacturer's published ratings for minimum and maximum refrigeration tonnage corresponding to this oil separating efficiency. Separator shall be equipped with a float valve to prevent return of the hot gas to crankcase, and shall have isolating stop valves so it can be opened and services without pumping out any other part of the system. ASME construction or UL listed.

2.2 GAUGES

- A. Temperature Gauges: Comply with ASME B40.200. Industrial-duty type and in required temperature range for service in which installed. Gauges shall have Celsius scale in 1-degree (Fahrenheit scale in 2-degree) graduations and with black number on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 1525 mm (5 feet) of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 1525 to 2135 mm (5 to 7 feet) above the finished floor. Remote element type temperature gauges shall be provided in thermal wells located 2135 mm (7 feet) above the finished floor.
- B. Vacuum and Pressure Gauges: Comply with ASME B40.100 and provide with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 90 mm (3-1/2 inches) in diameter with a range from 0 kPa (0 psig) to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.
 - 1. Suction: 101 kPa (30 inches Hg) vacuum to 1723 kPa (gauge) (250 psig).
 - 2. Discharge: 0 to 3445 kPa (gauge) (0 to 500 psig).

2.3 THERMOMETERS AND WELLS

- A. Refer to specification Section 23 21 13, HYDRONIC PIPING.

2.4 PIPE SUPPORTS

- A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.5 REFRIGERANTS AND OIL

- A. Provide EPA approved refrigerant and oil for proper system operation.

2.6 PIPE/CONDUIT ROOF PENETRATION COVER

- A. Prefabricated Roof Curb: Galvanized steel or extruded aluminum 300 mm (12 inches) overall height, continuous welded corner seams, treated wood nailer, 38 mm (1-1/2 inch) thick, 48 kg/cubic meter (3 pounds/cubic foot) density rigid mineral fiberboard insulation with metal liner, built-in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.
- B. Penetration Cover: Galvanized sheet metal with flanged removable top. Provide 38 mm (1-1/2 inch) thick mineral fiber board insulation.
- C. Flashing Sleeves: Provide sheet metal sleeves for conduit and pipe penetrations of the penetration cover. Seal watertight penetrations.

2.7 PIPE INSULATION FOR DX HVAC SYSTEMS

- A. Refer to specification Section 23 07 00, HVAC INSULATION.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5
 - 1. Install piping as short as possible, with a minimum number of joints, elbow and fittings.
 - 2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
 - 3. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown in the contract documents.
 - 4. Use copper tubing in protective conduit when installed below ground.
 - 5. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.
- B. Joint Construction:
 - 1. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8/A5.8M.
 - a Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.
 - b Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
 - c Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
 - d Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.
- C. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.
- D. Pipe relief valve discharge to outdoors for systems containing greater than 45 kg (100 lbs) of refrigerant.
- E. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 00, HVAC, INSULATION.
- F. If in the substantiated evaluation of the CxA, the installation fails to meet the requirements of the construction documents with respect to function and maintainability,

an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 PIPE AND TUBING INSULATION

- A. Refer to specification Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Apply two coats of weather-resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

3.3 SIGNS AND IDENTIFICATION

- A. Each refrigerating system erected on the premises shall be provided with an easily legible permanent sign securely attached and easily accessible, indicating thereon the name and address of the installer, the kind and total number of pounds of refrigerant required in the system for normal operations, and the field test pressure applied.
- B. Systems containing greater than 50 kg (110 lb) of refrigerant shall be provided with durable signs, in accordance with ANSI A13.1 and ANSI Z535.1, having letters not less than 13 mm (1/2 inch) in height designating:
 - 1. Valves and switches for controlling refrigerant flow, the ventilation and the refrigerant compressor(s).
 - 2. Signs on all exposed high pressure and low pressure piping installed outside the machinery room, with name of the refrigerant and the letters "HP" or "LP."

3.4 FIELD QUALITY CONTROL

- A. Prior to initial operation examine and inspect piping system for conformance to plans and specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.
- B. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of CxA. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.
 - 1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gauges, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.
 - 2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding DN 18 (NPS 5/8). This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 20 degrees C (68 degrees F) minimum.
- C. Test Medium: A suitable dry gas such as nitrogen or shall be used for pressure testing. The means used to build up test pressure shall have either a pressure-limiting device or pressure-reducing device with a pressure-relief device and a gauge on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

3.5 SYSTEM TEST AND CHARGING

- A. System Test and Charging: As recommended by the equipment manufacturer or as follows:
1. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 70 kPa (10 psig) gauge. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
 2. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
 3. Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gauge reading in mPa (microns). Pull the system down to 665 mPa (500 microns) 665 mPa (2245.6 inches of mercury at 60 degrees F) and hold for 8 hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

3.6 STARTUP AND TESTING

- A. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the CxA. Provide a minimum of 7 days prior notice.
- B. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of computer room air conditioning equipment.

3.7 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the CxA.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.8 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 1 hour to instruct personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 232300

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Site fabricated filler channels between coils and drain pans. Site fabricated replacement air handler wall panels.

1.2 RELATED WORK

- A. All DIVISION 1 - GENERAL REQUIREMENTS Sections
- B. Section 230500 – COMMON WORK RESULTS FOR HVAC
- C. Section 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC
- D. Section 230900 – INSTRUMENTATION AND CONTROL FOR HVAC
- E. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES
- B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 31 13, METAL DUCTS”, with applicable paragraph identification.
- C. Product Data: For each type of the following products
 - 1. Duct supports.
 - 2. Liners and gaskets.
 - 3. Seismic-restraint devices.
 - 4. Fittings.
 - 5. Flexible connectors (equipment to duct)

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible” and performance requirements and design criteria indicated. Contractor shall make every effort to match existing installation when installing new ductwork.

1. Static Pressure Classes:
 - a Supply Ducts (Low Pressure): 2-in wg.
 - b Return Ducts (Negative Pressure): 2-in wg.
2. Leakage Class:
 - a Round Supply Air Duct: 3 cfm/100 sq.ft at 1-inch wg
 - b Rectangular Supply-Air Duct: 6 cfm/100 sq.ft at 1-inch wg.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" based on indicated static -pressure class unless otherwise indicated.
- B. Transverse Joints: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 1-5, "Longitudinal Seams – Rectangular Ducts" for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 1-5, "Longitudinal Seams – Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible"
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable SMACNA's "HVAC Duct Construction Standards – Metal and Flexible"

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication requirements: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 3 "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Traverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-2, "Transverse Joints – Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-1, "Seams – Round Duct and Fittings," for static-pressure class, applicable sealing requirements,

materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees" for static-pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible"

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M
 - 1. Galvanized Coating Designation: G60 or G90
 - 2. Finishes for surfaces exposed to View: Mill phosphatized.
- C. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc coated steel pin, fully annealed for capacitor-discharge welding.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016 thick galvanized steel, aluminum or stainless steel: with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723: certified by an NRTL.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

- E. Steel Cables for Stainless-Steel Ducts; Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service: with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws: compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized – steel shapes and plates.
 - 2. Supports for Stainless -Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 GENERAL

- A. Every effort should be made to leave existing system intact. Only demolish ductwork required to effectively install new equipment.
- B. If an installation is unsatisfactory to the EOR, the Contractor shall correct the installation at no additional cost or time to the owner.
- C. The drawings show the general arrangement of duct and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment. Coordinate with other trades. Provide all necessary fittings, offsets and duct runs based on field measurements and at no additional cost or time to the Government. Coordinate with other trades for space available and relative location of HVAC equipment. Duct location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.
- D. Install ducts according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" unless otherwise indicated.
- E. Install round ducts in maximum practical lengths.
- F. Install ducts with fewest possible joints.
- G. Install factory- or shop fabricated fittings for changes in direction, size and shape and for branch connections and equipment connections.
- H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

- J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- K. All duct sizes listed on drawings are free-area sizes, contractor to compensate for insulation and/or liner.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 SEAM AND JOINT SEALING

- A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.
- B. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements."

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 4, "Hangers and Supports"
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories"
- B. Comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for branch, outlet and inlet and terminal unit connections.

END OF SECTION 233113

SECTION 23 34 00 HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Fans for heating, ventilating and air conditioning.
- C. Product Definitions: AMCA 99.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS.
- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- E. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC
- F. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- G. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.
- H. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- I. Section 23 09 23, INSTRUMENTATION and CONTROL FOR HVAC.
- J. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- K. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
- B. Air Movement and Control Association International, Inc. (AMCA):
 - 99-2016 Standards Handbook
 - 210-2016 Laboratory Methods of Testing Fans for Aerodynamic
Performance Rating
 - 300-2014 Reverberant Room Method for Sound Testing of Fans
- C. American Society for Testing and Materials (ASTM):
 - B117-2019 Standard Practice for Operating Salt Spray (Fog) Apparatus
 - D1735-2014 Standard Practice for Testing Water Resistance of Coatings
Using Water Fog Apparatus
 - D3359-2017 Standard Test Methods for Rating Adhesion by Tape Test

G152-2013(R2021).....Standard Practice for Operating Open Flame Carbon Arc Light
Apparatus for Exposure of NonMetallic Materials
G153-2013(R2021).....Standard Practice for Operating Enclosed Carbon Arc Light
Apparatus for Exposure of NonMetallic Materials

- D. National Fire Protection Association (NFPA):
NFPA 96-2021 Standard for Ventilation Control and Fire Protection of
Commercial Cooking Operations
- E. Underwriters Laboratories, Inc. (UL):
181-2013 Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturers Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Plenum fan, motors, and drives.
 - 2. Centrifugal fans, motors, drives, accessories, and coatings.
 - a Inline centrifugal fans.
 - b Utility fans and vent sets.
 - 3. Propeller fans.
 - 4. 1Belt guards.
- D. Certified sound power levels for each fan.
- E. Motor ratings, types, electrical characteristics, and accessories.
- F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.
- G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
- H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in

accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

- I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

- A. Fans and power ventilators shall bear the AMCA performance seal.
- B. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
- C. Fans and power ventilators shall comply with the following standards:
 1. Testing and Rating: AMCA 210.
 2. Sound Rating: AMCA 300.
- D. Vibration Tolerance for Fans and Power Ventilators: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- E. Performance Criteria:
 1. The fan schedule shall show the design air volume and static pressure. Select the fan motor hp by increasing the fan bhp by 10 percent to account for the drive losses and field conditions.
 2. Select the fan operating point as follows:
 3. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
 4. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency.
- F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.
- G. Corrosion Protection:
 1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturer's paint and paint system shall meet the minimum requirements of ASTM D1735 water fog, ASTM B117 salt spray, ASTM D3359 adhesion, and ASTM G152 and ASTM G153 for carbon arc light apparatus for exposure of non-metallic material.
 2. Fans for general purpose fume hoods, or chemical hoods, and radioisotope hoods shall be constructed of materials compatible with the chemicals being transported in the air through the fan.

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 EXTRA MATERIALS

- A. Provide one additional set of belts for all belt-driven fans.

PART 2 - PRODUCTS

2.1 PLENUM FAN

A. Plenum Fans – Single and/or Multiple Fans in an Array:

1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.
2. Allowable vibration tolerances for fans shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).
3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is not permitted.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is not permitted. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories
 - a Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.

2.2 CENTRIFUGAL FANS

- A. Record factory vibration test results on the fan or furnish to the Contractor.
- B. Fan arrangement, unless noted or approved otherwise:
 1. DWDI fans: Arrangement 3.
 2. SWSI fans:, See schedule on the drawings.
- C. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.
 1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet

fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 13 mm (1/2 inches) wire mesh screens for fan inlets without duct connections.

2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.
 3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
 4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 50,000 hours, and an average fatigue life of 200,000 hours. Extend filled lubrication tubes for interior bearings or ducted units to outside of housing.
 5. Belts: Oil resistant, non-sparking and non-static.
 6. Belt Drives: Factory installed with final alignment belt adjustment made after installation.
 7. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 hp, fixed pitch for use with motors greater than 15 hp. Select pulleys so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
 8. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Provide protective sheet metal enclosure for fans located outdoors. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for specifications.
 9. Furnish variable speed fan motor controllers where shown in the contract documents. Refer to Section 26 29 11, MOTOR CONTROLLERS. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for controller/motor combination requirements.
- D. Industrial Fans: Use where scheduled or in lieu of centrifugal fans for low volume high static service. Provide material handling flat blade type fan wheel.

2.3 POWER ROOF VENTILATOR

- A. Type: Centrifugal fan, backward inclined blades. Provide down-blast or up-blast type as indicated.
- B. Construction: Steel or aluminum, completely weatherproof, for curb mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide self-acting back draft damper. Provide electric motor operated damper where indicated.
- C. Motor and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Bearings shall be pillow block ball type with a minimum L-50 life of 200,000 hours. Motor shall be located out of air stream.
- D. Up-blast Type: Top discharge exhauster, motor out of air stream. For kitchen hood exhaust applications, provide grease trough on base and threaded drain. The mounting height of the kitchen up-blast exhaust fan shall be in compliance with NFPA 96. (Provide vented curb extension if required to maintain required clearances.)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. If an installation is unsatisfactory to the EOR, the contractor shall correct the installation at no additional cost or time to the State.
- B. Install fan, motor and drive in accordance with manufacturer's instructions.
- C. Align fan and motor sheaves to allow belts to run true and straight.
- D. Bolt equipment to curbs with galvanized lag bolts.
- E. Install vibration control devices as shown in the contract documents and specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

3.2 PRE-OPERATION MAINTENANCE

- A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.
- C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 STARTUP AND TESTING

- A. Verify operation of motor, drive system and fan wheel according to the contract documents.
- B. Check vibration and correct as necessary for air balance work.
- C. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- F. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 1 hour to instruct ISU personnel responsible in operation and maintenance of the system.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 233400

SECTION 23 36 00 AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Air terminal units and air flow control valves.

1.2 1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS.
- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- E. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- F. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.
- G. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- H. Section 23 09 23, INSTRUMENTATION and CONTROL for HVAC.
- I. Section 23 31 00, METAL DUCTS.
- J. Section 23 34 00, HVAC FANS
- K. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
- B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):
880-2017 Performance Rating of Air Terminals
- C. American Society for Testing and Materials (ASTM):
C665-2017 Standard Specification for Mineral-Fiber Blanket Thermal
Insulation for Light Frame Construction and
Manufactured Housing
- D. National Fire Protection Association (NFPA):
90A-2021 Standard for the Installation of Air-Conditioning and Ventilating
Systems
- E. Underwriters Laboratories, Inc. (UL):
181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Air flow control valves.
- D. Samples: Provide one typical air terminal unit for approval by the COR. This unit will be returned to the Contractor after all similar units have been shipped and deemed acceptable at the job site.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
- F. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- G. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 AS-BUILT DOCUMENTATION

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Coils:
 - 1. All Air Terminal Units: Provide Electric Heating coils.
 - 2. Electric Heating Coils:
 - a AHRI certified, spiral fin type.
 - b Capacity: As indicated, based on scheduled data.
 - c Coil: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings will not be allowed.

- B. Labeling: Control box shall be clearly marked with an identification label that lists such information as nominal CFM, maximum and minimum factory-set airflow limits, coil type and coil connection orientation, where applicable.
- C. Factory-calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.
- D. Dampers with internal air volume control, see Section 23 31 00, HVAC DUCTS and CASINGS.
- E. Terminal sound attenuators, see Section 23 31 00, HVAC DUCTS and CASINGS.
- F. Air terminal performance shall be in compliance with AHRI 880.

2.2 AIR TERMINAL UNITS (VAV BOXES)

- A. General: Factory-built, pressure independent units, factory set-field adjustable air flow rate, suitable for single duct applications. Use of dual-duct air terminal units is prohibited. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC work assumes factory set air volumes. Coordinate flow controller sequence and damper operation details with the contract drawings and Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. All air terminal units shall be brand new products of the same manufacturer.
- B. Capacity and Performance: The maximum capacity of a single terminal unit shall not exceed 566 Liters/second (1,200 cfm) with the exception of operating rooms and Cystoscopy rooms, which shall be served by a single air terminal unit at a maximum of 1,250 Liters/second (2,649 CFM).
- C. Sound Power Levels: Acoustic performance of the air terminal units shall be based on the design noise levels for the spaces stipulated in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Equipment schedule shall show the sound power levels in all octave bands. Terminal sound attenuators shall be provided, as required, to meet the intent of the design.
- D. Casing: Unit casing shall be constructed of galvanized steel no lighter than 0.85 mm (22 Gauge). Air terminal units serving the operating rooms and Cystoscopy rooms shall be fabricated without lining. Provide hanger brackets for attachment of supports.
 - 1. Lining Material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion as well as ASTM C665 antimicrobial requirements. Insulation shall consist of 13 mm (1/2 inch) thick non-porous foil faced rigid fiberglass insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Materials shall be non-friable and with surfaces, including all edges, fully encapsulated and faced with perforated metal or coated so that the air stream will not detach material. No lining material is permitted in the boxes serving operating rooms and Cystoscopy rooms.
 - 2. Access Panels (or doors): Provide panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same

standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.

3. Total leakage from casing, not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 750 Pa (3 inches WG), with all outlets sealed shut and inlets fully open.
- E. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.
 1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1 kPa (4 inches WG).
- F. Provide multi-point velocity pressure sensors with external pressure taps. Provide direct reading air flow rate table pasted to box.
- G. Provide static pressure tubes.
- H. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 23 09 23, INSTRUMENTATION and CONTROL SYSTEM for HVAC for factory mounting on air terminal units. The DDC controller shall be electrically actuated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. If an installation is unsatisfactory to the EOR, the contractor shall correct the installation at no additional cost or time to the State.
- B. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- C. Handle and install units in accordance with manufacturer's written instructions.
- D. Support units rigidly so they always remain stationary. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- E. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.

3.2 STARTUP AND TESTING

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the State.
- C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 1 hour to instruct personnel responsible in operation and maintenance of the system.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 233600

SECTION 23 40 00 PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Air filters for heating, ventilating and air conditioning.
- C. Definitions: Refer to ASHRAE 52.2 for definitions of face velocity, net effective filtering area, media velocity, initial resistance (pressure drop), MERV (Minimum Efficiency Reporting Value), PSE (Particle Size Efficiency), particle size ranges for each MERV number, dust holding capacity and explanation of electrostatic media based filtration products versus mechanical filtration products. Refer to ASHRAE 52.2 for definition of MERV-A.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- D. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only. Where conflicts occur these specifications and the University standards will govern.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
850-//2013// Performance Rating of Commercial and Industrial Air Filter Equipment
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
52.2-//2017// Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size
170-//2021// Ventilation of Health Care Facilities
- D. International Organization for Standardization (ISO):
9001-//2015(R2021)//Quality Management Systems - Requirements
- E. Underwriters Laboratories, Inc. (UL):
586-//2009(R2017)//Standard for High-Efficiency, Particulate, Air Filter Units
900-//2015// Standard for Air Filter Units

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Extended surface filters.
 - 2. Holding frames. Identify locations.
 - 3. Side access housings. Identify locations, verify insulated doors.
 - 4. Magnehelic gauges.
- D. Air Filter performance reports.
- E. Suppliers warranty.
- F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

- A. Air Filter Performance Report for Extended Surface Filters:
 - 1. Submit a test report for each Grade of filter being offered. The report shall not be more than three (3) years old and prepared by using test equipment, method and duct section as specified by ASHRAE 52.2 for type filter under test and acceptable to COR, indicating that filters comply with the requirements of this specification. Filters utilizing partial or complete synthetic media will be tested in compliance with pre-conditioning steps as stated in ASHRAE 52.2. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) face dimension. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.
- B. Filter Warranty for Extended Surface Filters: Guarantee the filters against leakage, blow-outs, and other deficiencies during their normal useful life, up to the time that the filter reaches the final pressure drop. Defective filters shall be replaced at no additional cost or time to the Government.
- C. Comply with UL 900 for flame test.
- D. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency//, UL classification// //, and file number//.

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED

- A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 01 00 00, GENERAL REQUIREMENTS. Provide one complete set of additional filters to the COR.
- B. The COR will direct whether these additional filters will either be installed as replacements for dirty units or turned over to VA for future use as replacements.

2.2 EXTENDED SURFACE AIR FILTERS

- A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall be of the extended surface type fabricated for disposal when the contaminant load limit is reached as indicated by maximum (final) pressure drop.
- B. Filter Classification: UL listed and approved conforming to UL 900.
- C. HVAC Filter Types:

HVAC Filter Types				
MERV Value ASHRAE 52.2		Application	Particle Size	Thickness /Type
8		Pre-Filter	3 to 10 Microns	50 mm (2 inch) Throwaway
11		After-Filter	1 to 3 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge
13		(Alternate) After-Filter	0.3 to 1 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge
14		After-Filter	0.3 to 1 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge

- D. HEPA Filters:

HEPA Filters				
Efficiency at 0.3 Micron	Application	Initial Resistance (inches WG)	Rated cfm	Construction
99.97	Final Filter	1.35	1100	Galvanized Frame X- Body
99.97	Final Filter	1.00	2000	Aluminum Frame V-

				Bank

2.3 MEDIUM EFFICIENCY PLEATED PANEL PRE-FILTERS (50 MM (2 INCH); MERV 8; UL 900 CLASS 2)

- A. Construction: Air filters shall be medium efficiency ASHRAE pleated panels consisting of cotton and synthetic or 100 percent virgin synthetic media, self-supporting media with required media stabilizers, and beverage board enclosing frame. Filter media shall be lofted to a uniform depth and formed into a uniform radial pleat. The media stabilizers shall be bonded to the downstream side of the media to maintain radial pleats and prevent media oscillation. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral diagonal support members on the air entering and air exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.
- B. Performance: The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE 52.2. The media shall maintain or increase in efficiency over the life of the filter. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) face dimension.

Minimum Efficiency Reporting (MERV)	8
Dust Holding Capacity (Grams)	105
Nominal Size (Inches Width x Height x Depth)	24x24x2
Rated Air Flow Capacity (cfm)	2,000
Rated Air Flow Rate (fpm)	500
Final Resistance (Inches WG)	1.0
Maximum Recommended Change-Out Resistance (Inches WG)	0.66
Rated Initial Resistance (Inches WG)	0.33

- C. The filters shall be approved and listed by Underwriters Laboratories, Inc. as Class 2 when tested according to UL 900.

2.4 HIGH EFFICIENCY EXTENDED SURFACE (INTERMEDIATE/AFTER (FINAL)) CARTRIDGE FILTERS (305 MM (12 INCH); MERV 14/13/11; UL 900 CLASS 2)

- A. Construction: Air filters shall consist of 8 pleated media packs assembled into 4 V-banks within a totally plastic frame. The filters shall be capable of operating at temperatures up to 80 degrees C (176 degrees F). The filters shall either fit without modification or be adaptable to the existing holding frames. The molded end panels are to be made of high impact polystyrene plastic. The center support members shall be made of ABS plastic. No metal components are to be used.
- B. Media: The media shall be made of micro glass fibers with a water repellent binder. The media shall be a dual density construction, with coarser fibers on the air entering side and finer fibers on the air leaving side. The media shall be pleated using separators made of continuous beads of low profile thermoplastic material. The media packs shall be bonded to the structural support members at all points of contact, this improves the rigidity as well as eliminates potential air bypass in the filter.

- C. Performance: Filters of the size, air flow capacity and nominal efficiency (MERV) shall meet the following rated performance specifications based on the ASHRAE 52.2 test method. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) header dimension.

Minimum Efficiency Reporting Value (MERV)	14	13	11
Gross Media Area (sf)	197	197	197
Dust Holding Capacity (Grams)	486	430	465
Nominal Size (Inches Width x Height x Depth)	24x24x12	24x24x12	24x24x12
Rated Air Flow Capacity (cfm)	2,000	2,000	2,000
Rated Air Flow Rate (fpm)	500	500	500
Final Resistance (Inches WG)	2.0	2.0	2.0
Maximum Recommended Change-Out Resistance (Inches WG)	0.74	0.68	0.54
Rated Initial Resistance (Inches WG)	0.37	0.34	0.27

2.5 INSTRUMENTATION

- A. Magnehelic Differential Pressure Filter Gauges: Nominal 100 mm (4 inch) diameter, 0 to 500 Pa (0 to 2 inches WG), 3 inch for HEPA range//, except for MERV 17 HEPA final filters, where the range shall be 0 to 750 Pa (0 to 3 inches WG)//. Gauges shall be flush-mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment.
- B. DDC Static (Differential) Air Pressure Measuring Station: Refer to Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.
- C. Provide one DDC sensor across each extended surface filter. Provide Petcocks for each gauge or sensor.
- D. Provide one common filter gauge for two-stage filter banks with isolation valves to allow differential pressure measurement.

2.6 HVAC EQUIPMENT FACTORY FILTERS

- A. Manufacturer standard filters within fabricated packaged equipment should be specified with the equipment and should adhere to industry standard.
- B. Cleanable filters are prohibited.
- C. Automatic roll type filters are prohibited.

2.7 FILTER RETURN GRILLES

- A. Refer to Section 23 37 00, AIR OUTLETS AND INLETS.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. If an installation is unsatisfactory to the EOR, the contractor shall correct the installation at no additional cost or time to the State.
- B. Install supports, filters, and gauges in accordance with manufacturer's instructions.
- C. Label clearly with words "Contaminated Air" on exhaust ducts leading to the HEPA filter housing.

3.2 STARTUP AND TESTING

- A. Clean and vacuum air handling units and plenums prior to starting air handling systems.
- B. Replace pre-filters and install clean filter units prior to final inspection as directed by the EOR.
- C. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- D. When any defects are detected, correct defects and repeat test at no additional cost or time to the State.
- E. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

END OF SECTION 23400

SECTION 23 62 13 – PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies packaged air-cooled refrigerant compressor and condenser units.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- C. Definitions:
 - 1. Energy Efficiency Ratio (EER): The ratio of net cooling capacity is Btu/h to total rate of electricity input in watts under designated operating conditions (Btu hour/Watt).
 - 2. Seasonal Energy Efficiency Ratio (EER): The ratio of the total cooling output of an air conditioner during its normal annual usage period for cooling in Btu/h divided by total electric energy input in watts during the same period (Btu hour/Watt).
 - 3. Unitary: A Unitary Air Conditioner consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well.
 - 4. Where such equipment is provided in greater than one assembly the separated assemblies are to be designed to be used together and the requirements of rating are based upon use of matched assemblies.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- D. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
- E. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- F. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.
- G. Section 23 07 11, HVAC INSULATION.
- H. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- I. Section 23 09 00, INSTRUMENTATION and CONTROL FOR HVAC.
- J. Section 23 11 23, FACILITY NATURAL-GAS PIPING.
- K. Section 23 23 00, REFRIGERANT PIPING.
- L. Section 23 31 13, HVAC DUCTS and CASINGS.
- M. Section 23 36 00, AIR TERMINAL UNITS.

N. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

O. Section 23 82 16, AIR COILS.

1.3 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 62 13, PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS", with applicable paragraph identification.
- C. Manufacturer's literature and data Including:
 - 1. Sufficient information, including capacities, pressure drops, and piping connections clearly presented, shall be included to determine compliance with contract documents for units noted below:
 - a packaged air-cooled refrigerant compressor and condenser units.
 - 2. Unit Dimensions required clearances, operating weights accessories and start-up instructions.
 - 3. Electrical requirements, wiring diagrams, interlocking and control wiring showing factory installed and portions to be field installed.
 - 4. Mounting and flashing of the roof curb to the roofing structure with coordinating requirements for the roof membrane system.
- D. Certification: Submit proof of specified ARI Certification.
- E. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, integrated energy efficiency ratio (IEER), and coefficient of performance (COP).
- F. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to COR three weeks prior to final inspection.
- G. Completed System Readiness Checklists provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.4 QUALITY ASSURANCE

- A. Refer to specification Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Safety Standards: ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the University standards will govern.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
210/240-2023 Performance Rating of Unitary Air-Conditioning and
Air-Source Heat Pump Equipment

- 270-2015 Sound Rating of Outdoor Unitary Equipment
- 340/360-(I-P 2019) Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
- 520-2004 Performance Rating of Positive Displacement Condensing Units
- C. American National Standards Institute (ANSI):
S12.51-2012(R2020) Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Method for Reverberation Rooms (same as ISO 3741:1999)
- D. American Society of Civil Engineers (ASCE)
ASCE 7-2017 Minimum Design Loads for Buildings and Other Structures
- E. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
Handbook 2016 HVAC Systems and Equipment
15-2019 Safety Standard for Refrigeration Systems (ANSI)
- F. American Society of Testing and Materials (ASTM):
B117-2019 Standard Practice for Operating Salt Spray (Fog) Apparatus
- G. National Electrical Manufacturer's Association (NEMA):
ICS 1-2005 Industrial Controls and Systems: General Requirements
MG 1-2016 (R2019) Motors and Generators (ANSI)
- H. National Fire Protection Association (NFPA) Publications:
90A-2021 Standard for the Installation of Air-Conditioning and Ventilating Systems

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 UNITARY AIR CONDITIONERS - GENERAL

- A. Applicable ARI Standards:
 - 1. Cooling Capacity 39.6 kW (135,000 Btu/hour) and greater: AHRI 340/ 360.
 - 2. Cooling Capacity Less Than 39.6 kW (135,000 Btu/hour): AHRI 210/240. Units shall be listed in the ARI Directory of Certified Unitary Air-Conditioners.

3. Condensing units shall have a power factor of not less than 85 percent under rated load conditions. Furnish units with a power factor of less than 85 percent with capacitors to provide a minimum power factor of 90 percent.
 4. Assemble condensing units on a heavy gauge integral steel base. Units shall be weatherproofed and include hermetic compressors, condenser coils, fans and motors (refer to Section 23 05 13, Common Motor Requirements for HVAC Equipment, for motor minimum efficiency), charging valves, and controls.
 5. Compressor-condenser (condensing) units shall have single point power connections.
 6. Condensing units on roof shall be mounted on Type "A" vibration isolators bolted to roof rails (refer to Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment). Condensing units on grade shall be bolted to concrete pads.
 7. Condensing units shall be equipped with an outside air temperature cut-off device. This device shall not allow condensing units to operate when the outside air temperature is 60 degrees or lower. This device shall be adjustable from 50 to 70 degrees.
 8. Provide and install a phase protection "Motor Saver type" controller on each condensing unit.
 9. All condensing units shall come equipped with mechanically fastened cotton wood screening.
- B. Performance Rating: Cooling capacity of units shall meet the sensible heat and total heat requirements shown in the contract documents. In selecting unit size, make true allowance for "sensible to total heat ratio" to satisfy required sensible cooling capacity.
- C. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated casings.
- D. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust beyond 3 mm (1/8-inch) on both sides from the scratch mark.

2.2 AIR COOLED CONDENSING UNITS

A. Unit Components:

1. Casing: Design unit casing for outdoor application and provide complete protection for components. Unit frame shall be 1-piece welded assembly of 12 gauge zinc coated steel formed channel members. Exterior surfaces shall be phosphatized, epoxy primed, and finished with baked on enamel. Casing shall have panels to provide complete access to controls, compressors, condenser fans, motors, and drives. Ship unit complete in one section as a factory assembly.

2. Refrigeration Circuits: Condensing units of 20-, 25- and 30-ton capacity shall have single refrigeration circuit. Condensing units of 40-, 50- and 60-ton capacity shall have (2) separate, independent refrigeration circuits. Units shall have provisions for a field installed hot gas bypass to be energized after last step of refrigeration for each refrigeration circuit. Refrigeration circuits shall have an integral subcooling circuit and a factory installed refrigerant dryer.
 - a Contractor shall furnish a factory installed APR valve bypass valve in each refrigerant circuit on units over 3 tons.
3. Compressor: (10, 12 1/2, 15 T - 2 Separate Circuits) Unit shall have direct drive, 3,600 rpm, scroll compressor(s) with centrifugal oil pump; 2-point lubrication for each bearing and connecting rod; crankcase heater and well; high strength, ring-type suction and discharge valves; large gas passages and minimum clearance volumes; and rubber-in-shear isolators.
 - a Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of nameplate voltage. Internal temperature and current-sensitive motor overloads shall protect compressor(s) under loss of charge and other abnormal operating conditions.
4. Compressor: (6 1/4 T through 15 T Single Circuit) Unit shall have direct drive, 2-speed, 3,500/1,750 rpm, scroll compressor with 2-stage centrifugal oil pump; belly-band crankcase heater; high strength, ring-type suction and discharge valves; and rubber-in-shear isolators.
 - a Motor shall be suction gas cooled and shall have voltage utilization range of plus or minus 10 percent of nameplate voltage. Solid state compressor motor protection module shall protect compressor against excessive temperature and current overload. Compressor motor protection module shall also provide anti-short cycle function to prevent compressor from operating for four minutes upon shut-down.
5. Compressor: (20, 25 and 30 T Single Circuit) (40, 50 and 60 T Double Circuit) Unit shall have direct drive, 1,750 rpm, scroll compressor with integral suction accumulator; centrifugal oil pump; oil filter screen and magnetic disks; oil level sightglass; oil charging valve; 2-point lubrication for each bearing and connecting rod; crankcase heater and well; double mesh inlet screen; high strength, non-flexing, ring-type suction, and discharge valves; large gas passages and minimum clearance volumes; electric actuated unloading; replaceable unloader solenoid valves; suction and discharge valves; and rubber-in-shear isolators.
 - a Motor shall be gas cooled and shall have voltage utilization range plus or minus 10 percent of nameplate voltage. Two winding thermostats imbedded between the 3 motor windings shall protect against excessive winding temperatures.
6. Condenser Coils: Condenser unit coils shall be slab-type (20-, 25-ton); "V"-type (30- to 60-ton), air-cooled. Configured aluminum fin secondary surface mechanically bonded to primary surface of 3/8-inch outside diameter seamless copper tubing. Subcooling circuit(s) with liquid accumulator(s) standard. Factory tested at 450 psig air pressure. Vacuum dehydrated. Louvered metal grilles for Coil Hail protection to be standard.
7. Condenser Fans: Condenser fans shall be vertical discharge, direct drive type fans, statically and dynamically balanced with aluminum blades and zinc plated steel

hubs. Fan motors shall be single or 3 phase with permanently lubricated ball bearings, built in current, and thermal overload protection and weathertight cover over shaft.

8. Controls: Provide high pressure protection on units either with internal pressure relief or external control in lockout circuit that can be reset by switching the thermostat. Furnish units with factory wired and mounted control panel with necessary controls and terminal blocks for power wiring and 24 volt control wiring. Controls shall include fused motor contactors, ambient fan switches, and a 208/240 volt control transformer. Provide a 4-minute time delay relay on units and a compressor sequencing control on dual compressor units.

- a Provide step capacity modulation with 115 volt control circuit, including fusing and control power transformer, wired complete with magnetic contactors for compressor and condenser fan motors, and 3-leg solid state compressor overload protection. Mount high and low pressure cutouts in compressor casing. Non-recycling pump-down and reset relay. Provide 4-minute time delay relay on units and a compressor sequencing control on dual compressor units.

- b Provide an ambient temperature lockout switch set for 55 degrees, adjustable from 50 to 70 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts. Secure condensing units to upper curb rail, and secure curb base to roof concrete tees with anchor bolts.
- B. Condensing Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure rooftop units to structural support with anchor bolts.
- C. Install wind restraints according to manufacturer's written instructions. restrained vibration isolation roof-curb rails are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- D. Install condensing units level and plumb maintaining manufacturer's recommended clearances and tolerances.
- E. Install vibration spring isolators under base of self-contained unit, with minimum static deflection of 25 mm (1 inch) unless otherwise indicated. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
- F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 25 mm (1 inch) unless otherwise indicated. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

3.2 CONNECTIONS

- A. Install piping adjacent to units to allow service and maintenance.
- B. Ground equipment and install power wiring, switches, and controls for self-contained and split systems.

- C. Connect refrigerant piping to coils with shutoff valves on the suction and liquid lines at the coil and a union or flange at each connection at the coil and condenser.
- D. Connect piping with shutoff duty valves on the supply and return side of the coil and unions at all connections and with a throttling valve on the return piping near the coil.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections: After installing units and after electrical circuitry has been energized, test units for compliance with requirements. Inspect for and remove shipping bolts, blocks, and tie-down straps. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP AND TESTING

- A. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum of 7 days prior notice.
- B. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

3.5 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the CxA.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.6 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 2 hours to instruct personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 236213

SECTION 23 73 00 INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Air handling units including integral components specified herein.
- C. Definition of Air Handling Unit (AHU): A factory-fabricated and tested assembly of modular sections consisting of housed-centrifugal fan with V-belt drive single or multiple plenum fans with direct-drive, coils, filters, and other necessary equipment to perform one or more of the following functions of circulating, cleaning, heating, cooling, humidifying, dehumidifying, and mixing of air. Design capacities of units shall be as scheduled in the contract documents.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS.
- D. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- E. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
- F. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- H. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- J. Section 23 21 13, HYDRONIC PIPING.
- K. Section 23 31 00, METAL DUCTS.
- L. Section 23 34 00, HVAC FANS.
- M. Section 23 40 00, PARTICULATE AIR FILTRATION.
- N. Section 23 82 16, AIR COILS.
- O. Section 23 05 14, MOTOR CONTROLLERS FOR HVAC.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
260-2017/ Sound Rating of Ducted Air Moving and Conditioning Equipment

410-2001 Forced-Circulation Air-Cooling and Air-Heating Coils with Addenda 1, 2 and
3

430-2020 Performance Rating of Central Station Air-Handling Unit Supply Fans

- C. Air Movement and Control Association International, Inc. (AMCA):
99-2016 Standards Handbook
210-2016 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance
Rating
- D. American Bearing Manufacturers Association (ABMA):
9-2015(R2020) Load Ratings and Fatigue Life for Ball Bearings
- E. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
(ASHRAE):
51-2016 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance
Rating
- F. American Society for Testing and Materials (ASTM):
A653/A653M-2020.....Standard Specification for Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed)
by the Hot-Dip Process
B117-2019 Standard Practice for Operating Salt Spray (Fog) Apparatus
D1654-2008(R2016)e1 Standard Test Method for Evaluation of Painted or Coated
Specimens Subjected to Corrosive Environments
D1735-2014 Standard Practice for Testing Water Resistance of Coatings Using Water
Fog Apparatus
D3359-2017 Standard Test Methods for Rating Adhesion by Tape Test
G152-2013(R2021).....Standard Practice for Operating Open Flame Carbon Arc Light
Apparatus for Exposure of Nonmetallic Materials
- G. Energy Policy Act of 2005 (P.L.109-58)
- H. National Fire Protection Association (NFPA):
70-2020 National Electrical Code
90A-2021 Standard for Installation of Air-Conditioning and Ventilating Systems
- I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
016-2012 HVAC Air Duct Leakage Test Manual, 2nd Edition

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with
Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Submittals for AHUs shall include fans, drives, motors, coils, mixing box with outside/return air dampers, filter housings, blender sections, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, diffusion plates, flexible connections, door swings, controls penetrations, electrical disconnect, lights, duplex receptacles, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc).
 - 2. Submittal drawings of section or component only will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves, or certified computer selection data; data sheets; fabrication and insulation details. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.
 - 3. Submit sound power levels in each octave band for the inlet and discharge of the fan and at entrance and discharge of AHUs at scheduled conditions. In absence of sound power ratings refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
 - 4. Provide fan curves showing Liters/Second (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design Liters/Second (cubic feet per minute).
 - 5. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule in the contract documents.
- D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.
- E. Submit shipping information that clearly indicates how the units will be shipped in compliance with the descriptions below.
 - 1. Units shall be shipped in one (1) piece where possible and in shrink wrapping to protect the unit from dirt, moisture and/or road salt.
 - 2. If not shipped in one (1) piece, provide manufacturer approved shipping splits where required for installation or to meet shipping and/or job site rigging requirements in modular sections. Indicate clearly that the shipping splits shown in the submittals have been verified to accommodate the construction constraints for rigging as required to complete installation and removal of any section for replacement through available access without adversely affecting other sections.
 - 3. If shipping splits are provided, each component shall be individually shrink wrapped to protect the unit and all necessary hardware (e.g., bolts, gaskets etc.) will be included to assemble unit onsite.

4. Lifting lugs will be provided to facilitate rigging on shipping splits and joining of segments. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.
- F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
 1. Include complete list indicating all components of the systems.
 2. Include instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list.
 3. Include complete diagrams of the internal wiring for each item of equipment.
 4. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
- G. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- H. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

- A. Comply with requirements in paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Air Handling Units Certification:
 1. Air Handling Units with Housed Centrifugal Fans: The air handling units shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
 2. Air Handling Units with Plenum Fans:
 - a Air Handling Units with a single Plenum Fan shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
 - b Air handling Units with Multiple Fans in an Array shall be tested and rated in accordance with AHRI 430 and AHRI 260.
- C. Heating, Cooling, and Air Handling Capacity and Performance Standards: AHRI 430, AHRI 410, ASHRAE 51, and AMCA 210.
- D. Performance Criteria:
 1. The fan BHP shall include all system effects for all fans and v-belt drive losses for housed centrifugal fans.
 2. The fan motor shall be selected within the rated nameplate capacity, without relying upon NEMA Standard Service Factor.
 3. Select the fan operating point as follows:
 - a Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.

- b Air Foil, Backward Inclined, or Tubular Fans Including Plenum Fans: At or near the peak static efficiency but at an appropriate distance from the stall line.
- 4. Operating Limits: AMCA 99 and manufacturer's recommendations.
- E. Units shall be factory-fabricated, assembled, and tested by a manufacturer, in business of manufacturing similar air-handling units for at least five (5) years.

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

- A. General:
 - 1. AHUs shall be fabricated from insulated, solid double-wall galvanized steel without any perforations in draw-through configuration. Galvanizing shall be hot dipped conforming to ASTM A653/A653M and shall provide a minimum of 0.275 kg of zinc per square meter (0.97 oz. of zinc per square foot) (G90). Aluminum constructed units, subject to ISU approval, may be used in place of galvanized steel. The unit manufacturer shall provide published documentation confirming that the structural rigidity of aluminum air-handling units is equal or greater than the specified galvanized steel.
 - 2. The contractor and the AHU manufacturer shall be responsible for ensuring that the unit will not exceed the allocated space shown in the contract documents, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost or time to the University.
 - 3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown in the contract documents. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. All units shall be fully assembled, tested, and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
 - 4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a factory-trained and qualified local representative at the job site to supervise the assembly and to assure that the units are assembled to meet manufacturer's recommendations and requirements noted in the contract documents. Provide documentation to the Contracting Officer that the local representative has provided services of similar magnitude and complexity on jobs of comparable size. If a local representative cannot be provided, the manufacturer shall provide a factory representative.

5. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high quality which seal airtight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 2000 Pa (8 inch WG) or higher.

B. Base:

1. Provide a heavy duty steel base for supporting all major AHU components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 127 mm (5 inch) high 3.5 mm (10 Gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for cooling coil condensate drain trap and steam coil condensate return trap as shown in the contract documents.
2. AHUs shall be completely self-supporting for installation on concrete housekeeping pad, steel support pedestals, or suspended as shown in the contract documents.
3. The AHU bases not constructed of galvanized steel shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

C. Casing (Including Wall, Floor, and Roof):

1. General: AHU casing shall be constructed as solid double wall, galvanized steel insulated panels without any perforations, integral of or attached to a structural frame. The thickness of insulation, mode of application and thermal breaks shall be such that there is no visible condensation on the exterior panels of the AHU located in the non-conditioned spaces.
2. Casing Construction:

Outer Panel	0.8 mm (22 Gauge) Minimum
Inner Panel	0.8 mm (22 Gauge) Minimum
Insulation	Foam
Thickness	50 mm (2 inch) Minimum
Density	48 kg/m ³ (3.0 lb/ft ³) Minimum
Total R Value	2.3 m ² .K/W (13.0 ft ² .°F.hr/Btu) Minimum

3. Casing Construction (Contractor's Option):

Outer Panel	1.3 mm (18 Gauge) Minimum
Inner Panel	1.0 mm (20 Gauge) Minimum

Insulation	Fiberglass
Thickness	50 mm (2 inch) Minimum
Density	24 kg/m ³ (1.5 lb/ft ³) Minimum
Total R Value	1.4 m ² .K/W (8.0 ft ² .°F.hr/Btu) Minimum

4. Blank-Off: Provide blank-offs as required to prevent air bypass between the AHU sections, around coils, and filters.
5. Casing panels shall be secured to the support structure with stainless-steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are prohibited.
6. Access Doors: Provide in each access section and where shown in the contract documents. Show single-sided and double-sided access doors with door swings on the floor plans. Doors shall be a minimum of 50 mm (2 inch) thick with same double wall construction as the unit casing. Doors shall be a minimum of 610 mm (24 inches) wide, unless shown of different size in the contract documents, and shall be the full casing height up to a maximum of 1829 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan section, mixing box, coil section shall include a minimum 152 mm x 152 mm (6 inch x 6 inch) double thickness, with air space between the glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame.
 - a Hinges: Manufacturer's standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 lb) weight hung on latch side of door.
 - b Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall allow the door to ajar and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening. Latch shall be capable of restraining explosive opening of door with a force not less than 2000 Pa (8 inch WG).
 - c Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.
7. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring and pneumatic tubing. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. Coordinate lights, switches, and duplex receptacles and disconnect switch location and mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.

D. Floor:

1. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (91 lbs per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.
 2. Where indicated, furnish and install floor drains flush with the floor, with nonferrous grate cover and stub through floor for external connection.
- E. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be double-wall, double sloping type, and fabricated from stainless-steel (304) with at least 50 mm (2 inch) thick insulation sandwiched between the inner and outer surfaces. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.
1. An intermediate, stainless-steel (304) condensate drip pan with copper downspouts shall be provided on stacked cooling coils. Use of intermediate condensate drain channel on upper casing of lower coil is permissible provided it is readily cleanable. Design of intermediate condensate drain shall prevent upper coil condensate from flowing across face of lower coil.
 2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
 3. Installation, including frame, shall be designed and sealed to prevent blow-by.
- F. Housed Centrifugal Fan Sections:
1. Fans shall be minimum Class II construction, double width, double inlet centrifugal, air foil or backward inclined forward curved type as indicated in the contract documents, factory balanced and rated in accordance with AMCA 210 or ASHRAE 51. Provide self-aligning, pillow block, regreasable ball-type bearings selected for a B (10) life of not less than 50,000 hours and an L (50) average fatigue life of 200,000 hours per ABMA 9. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in airstream to assure proper air flow.
 2. Provide internally vibration isolated fan, motor and drive, mounted on a common integral bolted or welded structural steel base with adjustable motor slide rail with locking device. Provide vibration isolators and flexible duct connections at fan discharge to completely isolate fan assembly. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, for additional requirements.
 3. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section

23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).

G. Fan Motor, Drive, and Mounting Assembly (Housed Centrifugal Fans):

1. Fan Motor and Drive: Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION, in the contract documents and suitable for use in variable frequency drive applications on AHUs where this type of drive is indicated. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Section 26 29 11, MOTOR CONTROLLERS.
2. Fan drive and belts shall be factory mounted with final alignment and belt adjustment to be made by the Contractor after installation. Drive and belts shall be as specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide additional drive(s) if required during balancing, to achieve desired airflow.

H. Plenum Fans – Single and/or Multiple Fans in an Array:

1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.
2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).
3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is prohibited.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is prohibited. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories:

- a Fan Isolation: Provide an actuator-controlled damper a manual blank off plate an automatic back draft damper to isolate the fan not in operation due to failure.
 - b Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.
- I. Fan Motor and Drive (Plenum Fans): Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT, in the contract documents and suitable for use in variable frequency drive applications. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Section 26 29 11, MOTOR CONTROLLERS.
- J. Multi-zone damper blades shall be galvanized steel or aluminum type. Dampers shall have metal compressible jamb seals and extruded vinyl or metal blade edge seals. Dampers shall rotate on stainless-steel bearings or bronze bushings. Leakage rate shall not exceed 2.5 cubic meters/minute/square meter (8 CFM per sq. foot) at 250 Pa (1 inch WG). Dampers and operators shall be furnished and factory-installed by AHU manufacturer. Damper operators shall be of the same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- K. Mixing Boxes: Mixing box shall consist of casing and outdoor air and return air dampers in opposed blade arrangement with damper linkage for automatic operation. Coordinate damper operator with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Dampers shall be of ultra-low leak design with metal compressible bronze jamb seals and extruded vinyl edge seals on all blades. Blades shall rotate on stainless-steel sleeve bearings or bronze bushings. Leakage rate shall not exceed 1.6 cubic meters/min/square meter (5 CFM per square foot) at 250 Pa (1 inch WG) and 2.8 cubic meters/min/square meter (9 CFM per square foot) at 995 Pa (4 inch WG). Electronic operators shall be furnished and mounted in an accessible and easily serviceable location by the air handling unit manufacturer at the factory. Damper operators shall be of same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- L. Blenders: Construction of the blender section shall be of welded aluminum 2 mm (0.081 inch) thick framing and turbulators. The mixer shall have no moving parts and shall contain a primary set of directional changing vanes, a secondary set of turbulator vanes, and a cone design for mixing of air streams. Certify blender performance to achieve no greater than a 5 degrees F variation across the cross section of the AHU measured 305 mm (12 inches) downstream of the blender over a face velocity range of 1-4 m/s (200-787 FPM).
- M. Filter Section: Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES, for filter requirements.
 - 1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be responsible for furnishing temporary filters (pre-filters and after-filters, as shown in the contract documents) required for AHU testing.
 - 2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors. Filter

housings shall be constructed in accordance with side service or holding frame housing requirements in Section 23 40 00, HVAC AIR CLEANING DEVICES.

- N. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent coil. Cooling coils and glycol-water exhaust heat recovery coils shall be designed and installed to ensure no condensate carry over. Provide factory-installed extended supply, return, drain, and vent piping connections. Coils installed in the air handling units serving surgical suites shall be equipped with copper fins. Copper fins are also required for all duct-mounted and terminal reheat coils. All coils in the high humidity areas, shall be epoxy-coated as shown below. Refer to the contract documents and Section 23 82 16, AIR COILS for additional coil requirements.
1. The coating process shall such that uniform coating thickness is maintained at the fin edges. The quality control shall be maintained by ensuring compliance to the applicable ASTM Standards for the following:
 - a Salt Spray Resistance (Minimum 6,000 Hours)
 - b Humidity Resistance (Minimum 1,000 Hours)
 - c Water Immersion (Minimum 260 Hours)
 - d Cross-Hatch Adhesion (Minimum 4B-5B Rating)
 - e Impact Resistance (Up to 160 Inch/Pound)
 2. Water coils including glycol-water.
- O. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.
- P. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, ELECTRICAL.
1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in access sections for fan, mixing box, humidifier, and any section over 305 mm (12 inch) wide. A switch shall control the lights in each compartment with pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory-installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
 2. Install compatible LED bulb in each light fixture.
 3. Provide a convenience duplex weatherproof receptacle next to the light switch.
 4. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Division 26, ELECTRICAL.
 5. Provide single point power connection. Coordinate with Division 26, ELECTRICAL.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. If an installation is unsatisfactory to the EOR, the contractor shall correct the installation at no additional cost or time to the State.
- B. Install air handling unit in conformance with AHRI 430.
- C. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Mil. Spec. P-21035B. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air handling units clean prior to operation.
- D. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Section 23 31 00, HVAC DUCTS AND CASINGS except leakage shall not exceed Leakage Class (CL) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.
- E. Perform field mechanical (vibration) balancing in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- F. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.

3.2 STARTUP AND TESTING

- A. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated, and the fan has been test run under observation.
- B. After the air handling unit is installed and tested, provide startup and operating instructions to ISU.
- C. An authorized factory representative should startup, test, and certify the final installation and application specific calibration of control components. Items to be verified include fan performance over entire operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, Owner/Operator training, etc.
- D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- E. When any defects are detected, correct defects and repeat test at no additional cost or time to the State.
- F. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

- B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 2 hours to instruct personnel responsible in operation and maintenance of the system.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 237300

SECTION 23 81 00 – DECENTRALIZED UNITARY HVAC EQUIPMENT (ROOFTOP UNITS)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies self-contained, rooftop, air conditioners and gas-fired furnaces.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- C. Definitions:
 - 1. Energy Efficiency Ratio (EER): The ratio of net cooling capacity in Btu/h to total rate of electricity input in watts under designated operating conditions (Btu hour/Watt).
 - 2. Seasonal Energy Efficiency Ratio (SEER): The ratio of the total cooling output of an air conditioner during its normal annual usage period for cooling in Btu/h divided by total electric energy input in watts during the same period (Btu hour/Watt).
 - 3. Unitary: A Unitary Air Conditioner consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well.
 - 4. Where such equipment is provided in greater than one assembly the separated assemblies are to be designed to be used together and the requirements of rating are based upon use of matched assemblies.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 07 72 00, ROOF ACCESSORIES.
- D. Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- E. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
- F. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- G. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.
- H. Section 23 07 00, HVAC INSULATION.
- I. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- J. Section 23 09 00, INSTRUMENTATION and CONTROL FOR HVAC.
- K. Section 23 11 23, FACILITY NATURAL-GAS PIPING.
- L. Section 23 23 00, REFRIGERANT PIPING.
- M. Section 23 31 00, HVAC DUCTS and CASINGS.

N. Section 23 82 16, AIR COILS.

1.3 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
- B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT”, with applicable paragraph identification.
- C. Manufacturer’s literature and data Including:
 - 1. Sufficient information, including capacities, pressure drops, and piping connections clearly presented, shall be included to determine compliance with contract documents for units noted below:
 - a Unitary air conditioners:
 - 1) Rooftop units
 - a) Gas-Fired Furnaces
 - 2. Unit Dimensions required clearances, operating weights accessories and start-up instructions.
 - 3. Electrical requirements, wiring diagrams, interlocking and control wiring showing factory installed and portions to be field installed.
 - 4. Mounting and flashing of the roof curb to the roofing structure with coordinating requirements for the roof membrane system.
- D. Certification: Submit proof of specified ARI Certification.
- E. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, integrated energy efficiency ratio (IEER), and coefficient of performance (COP).
- F. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to EOR three weeks prior to final inspection.
- G. Completed System Readiness Checklists provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.4 QUALITY ASSURANCE

- A. Refer to specification Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
- B. Safety Standards: ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the owner standards will govern.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

210/240-2023(2020)	Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment
270-2015	Sound Rating of Outdoor Unitary Equipment
310/380-2017	Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)
340/360-(I-P 2019)	Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
520-2004	Performance Rating of Positive Displacement Condensing Units
- C. Air Movement and Control Association (AMCA):
- | | |
|----------|---|
| 210-2016 | Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI) |
| 410-1996 | Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans |
- D. American National Standards Institute (ANSI):
- | | |
|--------------------|--|
| S12.51-2012(R2020) | Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Method for Reverberation Rooms (same as ISO 3741:1999) |
|--------------------|--|
- E. American Society of Civil Engineers (ASCE)
- | | |
|-------------|---|
| ASCE 7-2017 | Minimum Design Loads for Buildings and Other Structures |
|-------------|---|
- F. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
- | | |
|---------------|--|
| Handbook 2016 | HVAC Systems and Equipment |
| 15-2019 | Safety Standard for Refrigeration Systems (ANSI) |
| 62.1-2019 | Ventilation for Acceptable Indoor Air Quality (ANSI) |
- G. American Society of Testing and Materials (ASTM):
- | | |
|-----------|--|
| B117-2019 | Standard Practice for Operating Salt Spray (Fog) Apparatus |
|-----------|--|
- H. National Electrical Manufacturer's Association (NEMA):
- | | |
|-------------------|---|
| ICS 1-2005 | Industrial Controls and Systems: General Requirements |
| MG 1-2016 (R2019) | Motors and Generators (ANSI) |
- I. National Fire Protection Association (NFPA) Publications:

90A-2021

Standard for the Installation of Air-Conditioning and Ventilating Systems

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 ROOFTOP AIR CONDITIONERS

- A. Casing: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Exterior casing of 0.86 mm (0.034 inch) thick galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs. Casing insulation and adhesive shall comply with NFPA 90A or NFPA 90B and comply with ASTM C 1071, Type I and shall be 13 mm (1/2 inch) thick. Removable cam latched access panel to allow access to internal parts.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Supply-Air Fan: Direct driven, single width, backward inclined, centrifugal; with permanently lubricated, EC motor resiliently mounted in the fan inlet. Fan wheel shall be aluminum or painted-steel, and fan scroll shall be galvanized- or painted-steel.
- D. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
- E. Economizer/Relief-Air Fan: Forward curved, shaft mounted on permanently lubricated motor.
- F. Fan Motor: Comply with requirements in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.
- G. Supply-Air Refrigerant Coil: Aluminum-plate fins and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan. Coil split shall be interlaced. Coil shall have baked phenolic coating.
- H. Condensate Drain Pan: Formed sections of stainless-steel sheet, a minimum of 50 mm (2 inches) deep and complying with ASHRAE 62.1. Drain connections shall be threaded nipple.
- I. Outdoor-Air Refrigerant Coil: Aluminum-plate fins and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor. Polymer strip shall prevent copper coil from contacting steel coil frame or condensate pan. Coil shall have baked phenolic coating.
- J. Refrigerant Circuit Components:
 - 1. Number of Independent Refrigerant Circuits: as scheduled.
 - 2. Compressors: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

- K. Refrigerant: R-454B, or R-32 unless otherwise indicated.
- L. Refrigeration Specialties:
 - 1. Expansion valve with replaceable thermostatic element.
 - 2. Refrigerant filter/dryer.
 - 3. Manual-reset high-pressure safety switch.
 - 4. Automatic-reset low-pressure safety switch.
 - 5. Minimum off-time relay.
 - 6. Automatic-reset compressor motor thermal overload.
 - 7. Brass service valves installed in compressor suction and liquid lines.
 - 8. Low-ambient kit high-pressure sensor.
- M. Air Filtration: Minimum arrestance according to ASHRAE 52.1, and MERV rating according to ASHRAE 52.2.
 - 1. Pleated: Minimum 90 percent arrestance, and MERV 8.
- N. Gas Furnace: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54. Furnace shall be designed and certified by and bearing label of CSA.
 - 1. Burners: Stainless steel.
 - 2. Fuel: Natural gas.
 - 3. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 - 4. High-Altitude Model: For Project elevations greater than 610 m (2000 feet) above sea level.
 - 5. Heat-Exchanger and Drain Pan: Aluminized steel.
 - 6. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension.
 - 7. Safety Controls:
 - a Gas Control Valve: Two stage.
 - b Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
- O. Economizer Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
- P. Damper Motor: Modulating with adjustable minimum position.
- Q. Electrical Power Connection: A single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.
- R. Controls:

1. Unit Controls: Terminal strip for field installation of DDC. Coordinate requirements with the DDC contractor.
 2. Safety Control Operation:
 - a Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected and with additional contacts for alarm interface to fire alarm control panel.
 - b Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 4 degrees C (40 degrees F)].
 - c Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
 3. Interface Requirements for HVAC Instrumentation and Control System:
 - a Interface relay for scheduled operation.
 - b Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - c Compatible with BACnet for central HVAC control workstation for adjusting set points, monitoring supply fan start, stop, and operation, inquiring data to include outdoor-air damper position, supply- and room-air temperature, monitoring occupied and unoccupied operations, monitoring constant and variable motor loads, monitoring variable-frequency drive operation, monitoring cooling load, monitoring economizer cycles and monitoring air-distribution static pressure and ventilation air volume.
- S. Accessories:
1. Single point power connection.
 2. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.
 3. Low-ambient kit using staged condenser fans for operation down to 1.7 degrees C (35 degrees F).
 4. Filter differential pressure switch with sensor tubing on both sides of filter. Set for final filter pressure loss.
 5. Coil guards of painted, galvanized-steel wire.
 6. Hail guards of galvanized steel painted to match casing.
 7. Non-fused disconnect switch.
 8. Return Air Smoke Detector.
 9. MERV-8.
 10. Thru-the-base connections.
 11. High altitude kit.
 12. Ultra Low-Leak Economizer with drybulb sensor
 13. 14" roof curb.

- T. Roof curbs: Vibration isolators and wind or seismic restraints shall be as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Manufacturer's standard curbs constructed of galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
1. Curb Insulation and Adhesive: Factory applied and complying with NFPA 90A or NFPA 90B and ASTM C 1071, Type I or II. Thickness shall be 25 mm (1 inch) 38 mm (1-1/2 inches) (50 mm (2 inches) . Insulation shall be applied with adhesive and mechanical fasteners to the internal surface of curb. Liner adhesive shall comply with ASTM C 916, Type I. Liner shall be fastened with mechanical fasteners of galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied without causing leakage in cabinet. Liner materials shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity. Liner adhesive shall comply with ASTM C 916, Type I.
 2. Curb Height: 355 mm (14 inches).
 3. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT for wind-load requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 07 72 00, ROOF ACCESSORIES. Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- B. Rooftop Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure rooftop units to structural support with anchor bolts.
- C. Install units level and plumb maintaining manufacturer's recommended clearances and tolerances.
- D. Install water-cooled units with thermometer and pressure gauge at the water supply and return connection.
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
- F. Install wall sleeves in finished wall assembly and weatherproof. Install and anchor wall sleeves to withstand, without damage seismic forces as required by code.

3.2 CONNECTIONS

- A. Verify condensate drainage requirements.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- C. Install piping adjacent to units to allow service and maintenance.
- D. Gas Piping: Comply with applicable requirements in Section 23 11 23, FACILITY NATURAL-GAS PIPING. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- E. Install ducts to termination at top of roof curb. Cut roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
- F. Connect supply ducts to units with flexible duct connectors specified in Section 23 31 00, HVAC DUCTS and CASINGS.
- G. Install return-air duct continuously through roof structure.
- H. Ground equipment and install power wiring, switches, and controls for self-contained and split systems.
- I. Install ducts to the units with flexible duct connections.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections: After installing units and after electrical circuitry has been energized, test units for compliance with requirements. Inspect for and remove shipping bolts, blocks, and tie-down straps. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP AND TESTING

- A. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum of 7 days prior notice.
- B. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

3.5 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the CxA.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.6 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 1 hour to instruct owner's personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 238100

SECTION 23 82 16 AIR COILS

PART 1 - GENERAL

- 1.1 DESCRIPTION: Heating and cooling coils for air handling unit and duct applications
- 1.2 RELATED WORK
 - A. Section 01 33 00, SUBMITTAL PROCEDURES
 - B. Section 23 05 00, COMMON WORK RESULTS FOR HVAC
 - C. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS
 - D. Section 23 09 00, INSTRUMENTATION AND CONTROL SYSTEMS for HVAC
 - E. Section 23 31 13, METAL DUCTS AND CASINGS
- 1.3 QUALITY ASSURANCE
 - A. Refer to paragraph, QUALITY ASSURANCE, Section 23 05 00, COMMON WORK RESULTS FOR HVAC.
 - B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with AHRI Standard 410 and shall bear the AHRI certification label.
- 1.4 SUBMITTALS
 - A. Submit in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.
 - B. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves.
 - C. Provide installation, operating and maintenance instructions.
 - D. Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.
 - E. Completed System Readiness (Prefunctional) Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- 1.5 APPLICABLE PUBLICATIONS
 - A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
 - B. Air Conditioning and Refrigeration Institute (AHRI): Directory of Certified Applied Air Conditioning Products AHRI 410 Forced-Circulation Air-Cooling and Air-Heating Coils
 - C. American Society for Testing and Materials (ASTM): B75/75M-2019 Standard Specifications for Seamless Copper Tube
 - D. National Fire Protection Association (NFPA): 70 National Electric Code

- E. National Electric Manufacturers Association (NEMA): 250 Enclosures for Electrical Equipment (1,000 Volts Maximum)
- F. Underwriters Laboratories, Inc. (UL): 1996 Electric Duct Heaters

PART 2 - PRODUCTS

2.1 GENERAL COILS

- A. Conform to ASTM B75 and AHRI 410.
- B. Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing.
- C. Headers: Copper, welded steel or cast iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.
- D. "U" Bends, Where Used: Machine die-formed, silver brazed to tube ends.
- E. Coil Casing: 16 gage minimum galvanized steel with tube supports at 48 inch maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.
- F. Pressures PSIG:

Pressure	Water Coil		Steam Coil
Test	250		550
Working	200		150

- G. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.
- H. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.

2.2 REHEAT COILS, DUCT MOUNTED

- A. The coils shall be continuous circuit booster type for hot water as shown in contract documents. Use the same coil material as listed in paragraph HEATING AND COOLING COILS.

2.3 WATER COILS, INCLUDING GLYCOL-WATER

- A. Use the same coil material as listed in paragraph HEATING AND COOLING COILS.
- B. Drainable Type (Self-Draining, Self-Venting); Manufacturer Standard:
 - 1. Cooling, all types.
 - 2. Heating or preheat.

2.4 VOLATILE REFRIGERANT COILS

- A. Continuous circuit, straight tubes, dry expansion type equipped with multi-port distribution header, less expansion valve.

- B. Minimum 16 mm (5/8 inch) tube diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow coil manufacturer's instructions for handling, cleaning, installation and piping connections.
- B. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

3.2 STARTUP AND TESTING

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and as required by Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.

END OF SECTION 238216

SECTION 260500**GENERAL ELECTRICAL REQUIREMENTS****PART 1 - GENERAL****1.1 RELATED SECTIONS**

- A. Requirements of Section 260500 shall apply to all Sections of Division 1, 26, 27, and 28.

1.2 REFERENCES

- A. ASTM International (ASTM) Publications:
 - 1. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
- B. American Welding Society (AWS) Publications:
 - 1. D1.1 "Structural Welding Code - Steel"
- C. National Fire Protection Association (NFPA) Publications:
 - 1. 70 "National Electric Code"
- D. National Electrical Manufacturers Association (NEMA) Publications:
 - 1. 250 "Enclosures for Electrical Equipment (1000 Volts Maximum)"

1.3 WORK SCOPE

- A. The contractor shall furnish and install all labor, materials, gear, and equipment required to complete the work scope as indicated on the drawings and as specified in all other sections of Division 26, 27, and 28. Other labor, materials, gear, and equipment not specifically mentioned or implied, but required for a complete installation, shall be included for all systems be complete and ready for operation.

1.4 CODE COMPLIANCE

- A. All work and materials shall be installed in compliance with the current codes, standards, rules, ordinances and regulations adopted by the location of installation including, but not limited to, the following:
 - 1. International Building Code
 - 2. International Residential Code
 - 3. International Energy Conservation Code
 - 4. International Fire Code
 - 5. International Existing Building Code
 - 6. NFPA 70 – National Electric Code (NEC)
 - 7. NFPA 72 – National Fire Alarm and Signaling Code
 - 8. NFPA 101 – Life Safety Code
 - 9. All other applicable Federal, State and local laws and regulations.
 - 10. Occupational Safety and Health Act Standards (OSHA)
 - 11. ADA Standards for Accessible Design
 - 12. ANSI/IEEE C-2 – National Electrical Safety Code
 - 13. ANSI/ASME A17.1 2016, Safety Code for Elevators and Escalators
 - 14. ANSI/ASME A17.3 2015 Safety Code for Existing Elevators and Escalators
 - 15. ANSI/ASME A17.4 1999 Guide for Emergency Personnel
 - 16. ANSI/ASME A17.5 2014 Elevator and Escalator Electrical Equipment
 - 17. ANSI/ASME A17.6 2010 Standard for Elevator Suspension, and Governor Systems
 - 18. ANSI/ASME A17.7 2012 Performance-based Safety Code for Elevators and Escalators
 - 19. ANSI/ASME A17.8 2016 Standard for Wind Tower Turbine Elevators
 - 20. ANSI/ASME A18.1 2014 Safety Standards for Platform Lifts and Chairlifts
 - 21. ASME QE-1 2013 Standard for the Qualification of Elevator Inspectors
 - 22. NECA – Standard of Installation

- 23. Any / All other applicable federal, state, county, city, and local laws / ordinances / regulations.
- 24. Occupational Safety and Health Act Standards (OSHA)
- B. Work shall be installed and inspected by the local Authority Having Jurisdiction in accordance with all local codes / ordinances / regulations. Permit fees for inspection and all other fees shall be paid for by the contractor as part of this contract.

1.5 CONDITIONS AT SITE

- A. Contractors shall familiarize themselves with all existing conditions prior to submission of the bid. Additional costs for work required because of these conditions but not included in the bid will not be allowed, whether shown or implied in the contract drawings or not.

1.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings and specifications included in this contract are to be considered as a unified set. Any work related to this Division that appears anywhere in these documents shall be provided under the scope of this Division.
- B. The drawings are diagrammatic in nature and illustrate the general arrangement of equipment and wiring. They do not guarantee the most direct route of conduits or wiring. Actual installation requirements will be determined by architectural, structural, and mechanical site conditions. All related drawings must be reviewed when preparing the bid. Any additional wiring lengths, pull boxes, junction boxes, or other materials required due to site conditions must be accounted for in the bid. All information should be carefully verified, and any discrepancies must be reported prior to bid submission.
- C. No changes to the location, type, function, brand, finish, or similar characteristics of any item shall be made without prior engineering approval.
- D. While certain equipment is specifically identified on the drawings, this is not intended to establish a sole-source requirement unless explicitly stated. Product specifications are based on design criteria, and all bidders are encouraged to submit alternate products for prior approval. Approval must be obtained as outlined in the contract documents. Bids including unapproved products will be considered non-compliant, and the contractor will be required to furnish approved items at no additional cost to the owner. Submittals for non-approved equipment submitted after the contract award will not be reviewed or returned.
- E. In cases where conflicting information appears within the drawings and specifications, the contractor shall include the higher-cost option in the bid.

1.7 SAFETY AND INDEMNITY

- A. The contractor is solely responsible for job site safety, including all persons and property, at all times. The owner's reviews do not cover the contractor's safety measures.

1.8 CONSTRUCTION OBSERVATION BY THE ENGINEER

- A. Prior to covering: any major portion of the materials installed under this section, notify the engineer so that an observation can be made. Notification shall be made at least three (3) working days in advance of the date the items will be covered.

1.9 INSTRUCTION OF OWNER'S PERSONNEL

- A. The contractor shall provide an on-site instructional tour covering the entire project. Designated personnel from the owner's team shall be trained in the operation of all electrical systems, troubleshooting procedures, preventive maintenance practices, use of Operation and Maintenance manuals, maintenance and cleaning of lighting fixtures, and the operation of all specialized systems.
- B. The contractor shall include eight (8) hours of instruction time in their bid. This training will be conducted at the project site after substantial completion. The contractor shall coordinate with the owner to schedule the instruction, including determining the number of attendees, and shall provide the training schedule to the engineer.

1.10 PROJECT COMPLETION

- A. Upon completion of all work and operational testing of all systems, the contractor

- shall request a final construction observation by the engineer.
- B. The engineer will prepare a punch list of items requiring correction or completion. The contractor shall notify the engineer once all punch list items have been addressed.

1.11 GUARANTEE

- A. All electrical equipment and materials must be designed, manufactured, and tested in accordance with the latest applicable NEMA, IEEE, or ANSI standards.
- B. The contractor shall, at no cost to the owner, repair, revise, or replace any components found to be defective, inoperative, or failing within the guarantee period.

PART 2 - PRODUCTS

2.1 MATERIAL APPROVAL

- A. All electrical equipment and materials must be designed, manufactured, and tested in accordance with the latest applicable NEMA, IEEE, or ANSI standards.
- B. Materials shall be new (unless otherwise specified) and UL-listed. Items not subject to UL listing shall be tested and approved by an independent laboratory or governmental agency acceptable to both the owner and the code enforcement authority.
- C. Submit electronic copies (unless otherwise required in Division 1) of all Division 26, 27, and 28 shop drawings and material lists to the architect/engineer for review.
- D. Submittals shall contain:
1. The first section of the manual shall contain:
 - a. Names, addresses, and telephone numbers of Electrical Engineer, General Contractor, and any other contractors involved.
 2. Date of submission and dates of any previous submissions.
 3. Project title and number.
 4. Contract identification.
 5. The names of Contractor, Supplier, and Manufacturer.
 6. Identification of the product, with the Specification Section number.
 7. Field dimensions clearly identified as such.
 8. Relation to adjacent or critical features of the Work or materials.
 9. Identification of deviations from Contract Documents.
 10. Identification of revisions on resubmittals.
 11. An 6"x3" space for Engineer's and Contractors stamps.
 12. Contractor stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of the Contract Documents.
 13. Submittals shall be furnished on the following equipment:
 - a. Service Switchgear
 - b. CT Enclosures
 - c. Panelboards
 - d. Transformers
 - e. Disconnect Switches
 - f. Overcurrent Protective Devices
 - g. Motor Starters
 - h. Motor Control Centers
 - i. Light Fixtures
 - j. Emergency Lighting Battery Systems
 - k. Light Dimmers
 - l. Motion Sensors
 - m. Lighting Control Panels
 - n. Time Switches

- o. Receptacles
- p. Floor Boxes
- q. Explosion Proof Receptacles
- r. Switches
- s. Lightning Protection Systems
- t. Structured Cabling System
- u. Sound System Equipment
- v. Clocks
- w. Emergency Generator
 - 1) Emergency generator
 - 2) Battery Charger
 - 3) Tank Heater
 - 4) Fuel Tank
 - 5) Fuel Tank Monitoring System
 - 6) Muffler and Through Wall Thimble
 - 7) Breaker
 - 8) Automatic Transfer Switch
- x. Fire Alarm System
 - 1) Fire alarm control panel
 - 2) Auxiliary power panels
 - 3) Annunciator panels
 - 4) DACTS
 - 5) Ionization detectors
 - 6) Heat detectors
 - 7) Duct smoke detectors
 - 8) Audible/visual alarms
 - 9) Review drawings

2.2 OPERATION AND MAINTENANCE MANUALS

- A. Provide electronic copies (unless otherwise required in Division 1) of Operation and Maintenance Manuals for all Division 26, 27, and 28 systems and equipment to the architect/engineer..

2.3 RECORD DRAWINGS

- A. Submit complete and accurate record drawings as required by section 1.

2.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle all materials to prevent damage.
- B. Protect equipment from adverse weather conditions and moisture.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

- A. All work must reflect high-quality workmanship. Poor or careless installation practices will not be accepted.
- B. Assign a qualified foreman with a minimum of two (2) years of experience as a Journeyman Electrician on similar building types to always supervise this work.

3.2 COORDINATION

- A. Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under trades that require electrical connections. Inform contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.
- B. Verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without the authorization of the owner,

shall be at contractor's risk and expense.

3.3 MANUFACTURER'S INSTRUCTIONS

- A. All installations must comply with the manufacturer's instructions. A copy of these instructions shall be maintained in the superintendent's office and made available to the engineer upon request.
- B. Where the manufacturer's instructions cover items not shown on the drawings or specifications, they shall be followed. In the event of a conflict, seek clarification from the engineer before proceeding.

3.4 QUALITY ASSURANCE

- A. The contractor shall ensure all workmanship, materials, equipment, and installation methods meet accepted construction and engineering standards. All systems and components must function as intended.
- B. Perform quality assurance tests and operational checks on all components of the electrical distribution system, lighting fixtures, and special systems.

3.5 CUTTING AND PATCHING

- A. Perform all necessary cutting and fitting related to this Division's work during the building's rough construction phase.
- B. Any patching of finished surfaces shall be performed under the appropriate sections of the specifications.
- C. Structural elements such as joists, beams, girders, and columns shall not be cut without written approval from the architect or engineer.

END OF SECTION 260500

SECTION 26 05 02**ELECTRICAL DEMOLITION GENERAL PROVISIONS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Coordination and administrative requirements.
 - 2. Selective demolition of electrical systems.
- B. Related Requirements:
 - 1. Division 01 Sections apply to this Section.
 - 2. Section 01 10 00 – Summary.
 - 3. Section 01 30 00 – Administrative Requirements.
 - 4. Section 01 33 00 – Submittal Procedures.
 - 5. Section 01 40 00 – Quality Requirements.
 - 6. Section 01 50 00 – Temporary Facilities and Controls.
 - 7. Section 01 73 00 – Execution.
 - 8. Section 01 77 00 – Closeout Procedures.

1.2 REFERENCES

- A. Comply with applicable codes and standards:
 - 1. NFPA 70 – National Electrical Code (NEC).
 - 2. NFPA 70E – Electrical Safety in the Workplace.
 - 3. UL Standards.
 - 4. IEEE Standards.

1.3 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction.
- B. Selective Demolition: Removal of existing electrical components while maintaining required systems in operation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Equipment layouts.
 - 2. Wiring diagrams.
 - 3. Coordination drawings where required.
- C. Demolition Drawings:
 - 1. Indicate existing systems to be removed and to remain.
 - 2. Identify phasing and temporary power provisions.

1.5 INFORMATIONAL SUBMITTALS

- A. A. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with AHJ and NEC.
- B. Installer Qualifications: Licensed electricians.
- C. Electrical Components, Devices, and Accessories: Listed and labeled.
- D. Preinstallation Conference: Conduct for demolition and major installations.

1.7 COORDINATION

- A. Coordinate layout and installation with other construction.
- B. Verify dimensions and conditions.
- C. Coordinate shutdowns and outages.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate work to minimize disruption.
- B. Provide phasing plan indicating:

1. Demolition sequence.
2. Temporary power provisions.
3. System cutovers.

1.9 TEMPORARY ELECTRICAL SERVICES

- A. Provide temporary power and lighting as required.
- B. Maintain existing electrical service during construction.
- C. Remove temporary systems when no longer required.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Products: Comply with Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions affecting performance.
- B. Verify existing conditions.
- C. Proceed only after unsatisfactory conditions are corrected.

3.2 SELECTIVE DEMOLITION

- A. General:
 1. Comply with Division 01 Section "Execution."
 2. Remove only designated portions of electrical systems.
 3. Maintain operation of existing systems to remain.
- B. Existing Electrical Service:
 1. Do not interrupt service without approval.
 2. Provide temporary connections as required.
- C. Phasing:
 1. Perform demolition in phases.
 2. Schedule outages in advance.
- D. Temporary Power:
 1. Provide temporary feeders and connections.
 2. Maintain life safety systems in operation.
- E. Removal of Existing Work:
 1. Remove abandoned raceways, wiring, devices, and equipment.
 2. Remove exposed raceways in finished areas.
 3. Remove concealed raceways where accessible.
 4. Remove to source where possible.
- F. Existing Systems to Remain:
 1. Protect from damage.
 2. Repair damage caused by demolition.
- G. Hazardous Materials:
 1. Do not disturb.
 2. Notify Architect if encountered.
- H. Cleaning and Disposal:
 1. Remove debris promptly.
 2. Dispose in accordance with regulations.

3.3 CUTTING AND PATCHING

- A. Comply with Division 01 Section "Cutting and Patching."

3.4 INSTALLATION

- A. Install in accordance with NEC and manufacturer instructions.
- B. Provide complete systems.
- C. Install equipment level, plumb, and secure.

3.5 FIELD QUALITY CONTROL

- A. Comply with Division 01 requirements.

3.6 COMMISSIONING

- A. Comply with Division 01 commissioning requirements.

3.7 CLOSEOUT ACTIVITIES

- A. Comply with Division 01 Section "Closeout Procedures."
- B. Clean equipment and remove debris.
- C. Submit closeout documentation.

SECTION 26 05 03**COMMON WORK RESULTS FOR ELECTRICAL****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Common requirements for electrical installations.
 - 2. Coordination and administrative requirements.
 - 3. Cutting and patching.
 - 4. Selective demolition of electrical systems.
 - 5. Temporary electrical services.
- B. Related Requirements:
 - 1. Division 01 Sections apply to this Section.
 - 2. Section 01 10 00 – Summary.
 - 3. Section 01 20 00 – Price and Payment Procedures.
 - 4. Section 01 30 00 – Administrative Requirements.
 - 5. Section 01 33 00 – Submittal Procedures.
 - 6. Section 01 40 00 – Quality Requirements.
 - 7. Section 01 50 00 – Temporary Facilities and Controls.
 - 8. Section 01 60 00 – Product Requirements.
 - 9. Section 01 73 00 – Execution.
 - 10. Section 01 73 29 – Cutting and Patching.
 - 11. Section 01 77 00 – Closeout Procedures.

1.2 REFERENCES

- A. Comply with applicable codes and standards:
 - 1. NFPA 70 – National Electrical Code (NEC).
 - 2. NFPA 70E – Electrical Safety in the Workplace.
 - 3. UL Standards.
 - 4. IEEE Standards.

1.3 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction.
- B. Selective Demolition: Removal of existing electrical components while maintaining required systems in operation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Equipment layouts.
 - 2. Wiring diagrams.
 - 3. Coordination drawings where required.
- C. Demolition Drawings:
 - 1. Indicate existing systems to be removed and to remain.
 - 2. Identify phasing and temporary power provisions.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings.
- B. Field quality-control reports.
- C. Test reports.
- D. Commissioning documentation:
 - 1. Pre-functional checklists.
 - 2. Functional performance test procedures.
 - 3. Test results.

1.6 CLOSEOUT SUBMITTALS

- A. Record Drawings.
- B. Operation and Maintenance Data.
- C. Warranties.

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with AHJ and NEC.
- B. Installer Qualifications: Licensed electricians.
- C. Electrical Components, Devices, and Accessories: Listed and labeled.
- D. Preinstallation Conference: Conduct for demolition and major installations.

1.8 COORDINATION

- A. Coordinate layout and installation with other construction.
- B. Verify dimensions and conditions.
- C. Coordinate shutdowns and outages.

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate work to minimize disruption.
- B. Provide phasing plan indicating:
 - 1. Demolition sequence.
 - 2. Temporary power provisions.
 - 3. System cutovers.

1.10 TEMPORARY ELECTRICAL SERVICES

- A. Provide temporary power and lighting as required.
- B. Maintain existing electrical service during construction.
- C. Provide temporary feeders, panels, and protection.
- D. Remove temporary systems when no longer required.

PART 2 - PRODUCTS**2.1 GENERAL REQUIREMENTS**

- A. Products: Comply with Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled.
- C. Materials: New and suitable for environment.

2.2 SUPPORTS AND FASTENERS

- A. Comply with Section 26 05 29.
- B. Provide anchors, supports, and fasteners suitable for installation conditions.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine conditions affecting performance.
- B. Verify existing conditions.
- C. Proceed only after unsatisfactory conditions are corrected.

3.2 SELECTIVE DEMOLITION

- A. General:
 - 1. Comply with Division 01 Section "Execution."
 - 2. Remove only designated portions of electrical systems.
 - 3. Maintain operation of existing systems to remain.
- B. Existing Electrical Service:
 - 1. Do not interrupt service without approval.
 - 2. Provide temporary connections as required.
- C. Phasing:

1. Perform demolition in phases.
 2. Schedule outages in advance.
- D. Temporary Power:
 1. Provide temporary feeders and connections.
 2. Maintain life safety systems in operation.
- E. Removal of Existing Work:
 1. Remove abandoned raceways, wiring, devices, and equipment.
 2. Remove exposed raceways in finished areas.
 3. Remove concealed raceways where accessible.
 4. Remove to source where possible.
- F. Existing Systems to Remain:
 1. Protect from damage.
 2. Repair damage caused by demolition.
- G. Hazardous Materials:
 1. Do not disturb.
 2. Notify Architect if encountered.
- H. Cleaning and Disposal:
 1. Remove debris promptly.
 2. Dispose in accordance with regulations.

3.3 CUTTING AND PATCHING

- A. Comply with Division 01 Section "Cutting and Patching."
- B. Restore finishes to match existing.

3.4 INSTALLATION

- A. Install in accordance with NEC and manufacturer instructions.
- B. Provide complete systems.
- C. Install equipment level, plumb, and secure.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Verify system continuity and grounding.
- C. Submit reports.

3.6 COMMISSIONING

- A. Comply with Division 01 commissioning requirements.
- B. Provide:
 1. Pre-functional checklists.
 2. Functional performance testing support.
- C. Correct deficiencies.

3.7 CLOSEOUT ACTIVITIES

- A. Comply with Division 01 Section "Closeout Procedures."
- B. Clean equipment and remove debris.
- C. Submit closeout documentation.

END OF SECTION 260503

SECTION 260519**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 REFERENCES

- A. National Electrical Manufacturer's Association (NEMA) Publications:
 - 1. WC 26 "Binational Wire and Cable Packaging Standard"
 - 2. WC 70 "Nonshielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy"
- B. National Fire Protection Association (NFPA) Publications:
 - 1. 70 "National Electric Code"
- C. Idaho State University Section 271500 - ISU Telecommunications Cabling - CAT6
- D. Underwriter's Laboratories, Inc. (UL) Publications:
 - 1. 486A "Standard For Wire Connectors and Soldering Lugs for Use with Copper Conductors"
 - 2. 486B "Standard for Wire Connectors for Use With Aluminum Conductors"

1.3 SUBMITTALS

- A. Submit the following in accordance with Conditions of Contract and Division 01

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.
- C. Coordinate layout and installation of conductors and cables with trades of other divisions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Owner's Representative.

PART 2 - PRODUCTS**2.1 BUILDING WIRES AND CABLES**

- A. Approved Manufacturers:
 - 1. American Insulated Wire Corp.; Leviton Manufacturing Co. (800-366-2492)
 - 2. Carol Cable Co., Inc. (401-728-7000)
 - 3. Southwire Company (800-444-1700)
 - 4. Alcan Cable Division of Alcan Aluminum Corporation (770-392-2368)
- B. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

- C. Rubber Insulation Material: Comply with NEMA WC 70.
- D. Thermoplastic Insulation Material: Comply with NEMA WC 70.
- E. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 70.
- F. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 70.
- G. Conductor Material: Copper
 - 1. Feeders 100 ampere or greater may be aluminum "Alcan Stabiloy #8000", or approved substitution by listed manufacturers. Upsize conduit and wire as required.
 - 2. All aluminum conductors shall include Burndy Hyplug connectors at each end of cable.
- H. Stranding: Solid conductor for No. 12 AWG and smaller; stranded conductor for larger than No. 10 AWG.

2.2 CONNECTORS AND SPLICES

- A. Approved Manufacturers:
 - 1. AMP Incorporated (800-522-6752)
 - 2. General Signal; O-Z/Gedney Unit (203-584-0571)
 - 3. Square D Co.; a Division of Groupe Schneider (888-778-2733)
 - 4. Alcan Cable Division of Alcan Aluminum Corporation (770-392-2368)
- B. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

- A. Service Entrance: Type RHW or THWN, in raceway
- B. Horizontal Feeders: Type THHN/THWN, in raceway
- C. Vertical Feeders: Type THHN/THWN in raceway
- D. Horizontal Branch Circuits: Type THHN/THWN, in raceway
- E. Vertical Branch Circuits: Type THNN/THWW in raceway

3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Section 26 05 00 - "Common Work Results for Electrical."
- F. Seal around cables penetrating fire-rated elements according to Section 07 84 00 "Firestopping."
- G. Identify wires and cables according to Section 26 05 53 "Identification for Electrical

Systems."

- H. All line voltage branch circuits shall be #12 AWG or larger.
- I. The contractor is responsible for installing conductor size for branch circuits as required to maintain a maximum of 3% voltage drop.
- J. Provide and separate neutral and equipment grounding conductor with all branch circuits.
- K. Provide a separate neutral for each ungrounded conductor. Ungrounded conductors may share a neutral in accordance with NEC 200.4(B)

3.4 CONNECTIONS

- A. Conductor Splices: Keep to a minimum.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Splices are allowed only in junction boxes.
- E. Use oxide inhibitor in each splice and tap connector for aluminum conductors.
- F. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- G. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- H. Terminate spare conductors with wire connectors and electrical tape.
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Inspect conductor and cable prior to installation for physical damage. Perform meggar and continuity tests on all conductors suspected of damage prior to installation to confirm manufacturer specifications.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- C. Verify correct conductor phasing prior to connecting conductors and cables and energizing equipment.

END OF SECTION 260519

SECTION 260526**GROUNDING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment to concrete encased electrode, metal underground water pipe, and effectively grounded metal frame of building.
- B. Ground each separately-derived system neutral to nearest effectively grounded metal structural frame of building or point of service entrance ground.
- C. Provide communications system grounding conductor to point of service entrance ground.
- D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground connectors, and plumbing systems.

1.4 QUALITY ASSURANCE

- A. Testing: Refer to Section 260501 – Field Test and Operational Check.

PART 2 - PRODUCTS**2.1 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Section 260519 - Conductors and Cables.
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow tracer. Where not available, green and yellow tape at each junction box or device enclosure.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

- F. Bare Copper Conductors: Medium hard drawn copper conductor, stranded, sized as shown on the drawings.
- G. Hardware: Bolts, nuts and washers shall be bronze; cadmium plated steel or other non-corrosive material, approved for the purpose.
- H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.2 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- D. Below grade compression fittings: Thomas & Betts, Series 52000, 53000, and 54000 or equivalent.
- E. Use connector and sealant approved for purpose on all below grade clamp or compression type connections.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, 5/8 inch diameter, minimum length 8 feet.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
- F. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NEC Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NEC are

indicated.

- B. Install equipment grounding conductors in all feeders and circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
- D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways bonded to outlet or equipment, sized per Section 250 of the NEC.
- G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - PART 4 - Service and Central Equipment Locations and Wiring Closets:** Terminate grounding conductor on grounding bar.
 - PART 5 - Terminal Cabinets:** Terminate grounding conductor on cabinet grounding terminal.
- A. Provide green insulated ground conductor to exterior post light standards.
- B. Provide grounding and bonding at pad-mounted transformer in accordance with Section 261200.

5.2 INSTALLATION

- A. Ground Rods: Where indicated, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, unless otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any

adjacent parts. Install straps only in locations accessible for maintenance.

- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC 250, using a minimum of *20 feet* of bare copper conductor not smaller than No. 4 AWG. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

5.3 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 1. Make connections with clean, bare metal at points of contact.
 - 2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 3. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 4. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

5.4 SYSTEM NEUTRAL GROUND

- A. Ground the neutral conductor of each transformer or generator to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.
- B. Ground generators or transformers with secondary voltage 600 volt or less as follows:
PART 6 - 3 phase, 4 wire Wye connected: ground neutral point
- A. For transformers 75 kVA or smaller with primary voltage 480 volt or less the primary equipment ground conductor may be used for grounding the secondary neutral provided it is adequately sized in accordance with NEC system ground conductor size.

6.2 EQUIPMENT GROUND

- A. Ground non-current carrying metal parts of electrical equipment enclosures, frames, conductor raceways or cable trays to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together. Install a grounding conductor in each raceway system. Equipment grounding conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size grounding conductors per NEC 250 unless otherwise shown on the drawings.
- B. Install metal raceway couplings, fittings, and terminations secure and tight to ensure good grounding continuity. Provide grounding conductor sized per NEC through all raceway and conduit systems.
- C. Lighting fixtures shall be securely connected to equipment grounding conductors. Outdoor lighting standards shall have a factory installed ground lug for terminating the grounding conductor.
- D. Motors shall be connected to equipment ground conductors with a bolted solderless lug connection on the metal frame.

6.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Test ground system per Section 260501.

END OF SECTION 260526

SECTION 260533**RACEWAYS AND BOXES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring systems.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid Polyvinyl Chloride conduit.
- G. PVC: Rigid Polyvinyl Chloride conduit
- H. HDPE: High Density Polyethylene Conduit

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS**2.1 METAL CONDUIT AND TUBING**

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. PVC coated Steel Conduit and Fittings: NEMA RN 1; rigid steel conduit with external 40 mil PVC coating and internal two mil urethane coating.
- D. EMT and Fittings: ANSI C80.3. Fittings: Set-screw type.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Schedule 40 PVC. Fittings: NEMA TC 3; match to conduit and material.

2.3 METAL WIREWAYS

- A. Material: Sheet metal as specified.
- B. Include accessories for complete installation.
- C. Finish: Manufacturer's standard enamel

2.4 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, gasketed cover

2.5 FLOOR BOXES

- A. Floor Boxes: Cast metal, fully adjustable, rectangular, unless otherwise specified.

2.6 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.7 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250 Types 1, 3R, or 4
- B. NEMA 250 Type 1, galvanized steel, with removable panel and hinged door, keyed to match panelboards.
- C. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

2.8 J-HOOKS

- A. J-hooks:
 - 1. Steel, indoor rated for structured cabling support.
 - 2. Compatible fittings and supports per manufacturer.
 - 3. Acceptable Product: Caddy CableCat or equal D. Manufacturer: Erico or equal.

2.9 INNERDUCT

- A. Innerduct:
 - 1. NNEMA TC 5 compliant, UL Listed, corrugated.
- B. Acceptable Manufactures:
 - 1. Arnco
 - 2. Carlon
 - 3. Dura-line
 - 4. Pyramid
- C. Composition:
 - 1. HDPE or PE (non-plenum); as rated (plenum).
- D. Minimum ID: 1 inch E. Pulling Strength: 600 lbs minimum.
- E. Color: Orange.
- F. Include manufacturer fittings for complete system.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify surfaces and conditions are acceptable for installation. Correct deficiencies before proceeding.

3.2 WIRING METHODS

- A. Outdoors:
 - 1. Exposed / Concealed: Rigid steel or IMC.
 - 2. Underground: RNC or PVC-coated RMC per NEC 517.13
 - 3. Equipment Connections: LFMC
 - 4. Enclosures: Type 3R or 4.
- B. Indoors: Use the following wiring methods:
 - 1. Exposed / Concealed: EMT or metallic raceways.
 - 2. Public Areas: Metallic raceways only, with Architect approval.
 - 3. Concealed: MC Cable (no homeruns).
 - 4. Patient Care: EMT or Hospital Grade MC Cable.
 - 5. Damp/Wet: RMC.
 - 6. Enclosures: NEMA Type 1 or 4 / 4X / 12 for wet/dusty/corrosive areas.

3.3 INSTALLATION

- A. Install per manufacturer's instructions.
- B. Minimum Raceway Size:

1. 1/2-inch trade size, if product knock out is 1/2-inch.
 2. 3/4-inch for homeruns.
 3. Conceal raceways unless noted.
 4. Maintain clearances from heat sources.
 5. Use correct routing, supports, fittings, and firestopping.
 6. Terminate and label per requirements.
 7. Maintain installation quality and alignment.
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and

3.4 SUPPORT INSTALLATION

1. Use proper hangers, clamps, rods, and fasteners.
2. Space supports appropriately.
3. Accommodate future additions (25% minimum).
4. Fasten to structure, not piping or ductwork.
5. Meet seismic requirements.

3.5 BOX INSTALLATION

1. Avoid back-to-back boxes in walls.
2. Coordinate box placement with other trades.
3. Use appropriate box size and type.
4. Maintain accessibility and secure mounting.

3.6 LABELING

- A. Label cover plate of junction and pull boxes with system voltage and panel circuit.

3.7 CLEANING

- A. On completion of installation. Remove debris and inspect installation for completeness.

END OF SECTION 260533

SECTION 260553**IDENTIFICATION FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCES

- A. American National Standards Institute (ANSI) Publications:
- B. National Fire Protection Association (NFPA) Publications:
 - 1. 70 "National Electric Code"

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:
 - 1. Product Data: For each electrical identification product indicated.

1.5 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Approved Manufacturers:
 - 1. Brady USA, Inc. (800-541-1686)
 - 2. Panduit corp. (800-777-3300)
 - 3. Seton Identification Products (800-571-2596)

2.2 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage
- B. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- C. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick 1 to 2 inches wide.
- D. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.

- E. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- F. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- G. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.
- H. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

2.3 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: According to color-coding.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- F. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or

- equivalent.
- G. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where the width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- H. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.
1. Wire color code:
 - a. Color code for 240/120V system shall be as follows:
 - 1) Phase A: Black
 - 2) Phase B: Red
 - 3) Neutral: White
 - 4) Ground: Green
 - b. Color-code for 208/120V system shall be as follows:
 - 1) Phase A: Black
 - 2) Phase B: Red
 - 3) Phase C: Blue
 - 4) Neutral: White
 - 5) Ground: Green
 - c. Color-code for 480/277V system shall be as follows:
 - 1) Phase A: Brown
 - 2) Phase B: Orange
 - 3) Phase C: Yellow
 - 4) Neutral: Gray
 - 5) Ground: Green
 2. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in specified colors. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified colors to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
 - I. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 2. Tag Fasteners: Nylon cable ties.
 3. Band Fasteners: Integral ears.
 - J. Apply identification to conductors as follows:
 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
 - K. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with an approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- L. Equipment Identification Labels: Engraved plastic laminate. Install each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch high lettering on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
 1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Electrical switchgear and switchboards.
 4. Emergency system boxes and enclosures.
 5. Disconnect switches.
 6. Enclosed circuit breakers.
 7. Motor starters.
 8. Dimmers.
 9. Control devices.
 10. Telephone switching equipment.
 11. Label inside of all switch plates and cover plates with panel and circuit numbers.
 12. Label all disconnect switches with circuit number and equipment server inside disconnect switch as well as outside of switch.

END OF SECTION 260553

SECTION 262200**DRY-TYPE TRANSFORMERS (1000 V AND LESS)****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes dry-type distribution and specialty transformers rated 1000 V and less.

1.3 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance for each type of transformer specified. Include dimensioned plans, sections, and elevation views. Show minimum clearances and installed devices and features.
- B. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field-installed wiring.
- C. Factory Test Reports: Copy of manufacturer's design and routine factory tests required by referenced standards.
- D. Sound-Level Test Reports: Copy of manufacturer's sound-level tests applicable to equipment for this project.
- E. Maintenance Data: For transformers.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide transformers specified in this section that are listed and labeled as defined in the NEC.
- B. Equipment shall conform or exceed requirements of NEMA, ANSI Standard C89.2 for dry-type transformers for general applications.
- C. Comply with the NEC.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Approved Manufacturers:
 - 1. Cutler-Hammer; Eaton Corporation.
 - 2. ABB / General Electric Company; Electrical Distribution & Control Div.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; Schneider Electric.
 - 5. Or Equal

2.2 TRANSFORMERS, GENERAL

- A. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- B. Cores: Grain-oriented, nonaging silicon steel.
- C. Coils: Continuous windings without splices, except for taps.
- D. Internal Coil Connections: Brazed or pressure type.
- E. Enclosure: Class complies with NEMA 250 for the environment in which installed.
- F. Low-Sound-Level Units: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

- A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Windings: One coil per phase in primary and secondary.
- D. Electrical ratings:
 - 1. Primary winding voltage: 480 volts, 3 phase, delta.
 - 2. Secondary winding voltage: 120/208 volts, 3 phase grounded wye.
 - 3. KVA rating: As indicated on drawings.
- E. Enclosure: Indoor, ventilated.
- F. Temperature classification:
 - 1. Winding temperature rise shall be 150 degrees C in accordance with UL specification 506 with insulation Class 220 degree Celsius.
- G. Load rating:
 - 1. Transformer shall be capable of operating at 100% of nameplate rating continuously while in an ambient temperature not exceeding 40 degrees C.
 - 2. Transformer shall meet the daily overload requirements of ANSI Standard C57.96.
- H. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:
 - 1. Taps, 3 through 10 kVA: Two 5-percent taps below rated high voltage.
 - 2. Taps, 15 through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.
 - 3. Taps, 750 kVA and Above: Four 2.5-percent taps, 2 above and 2 below rated high voltage.
- I. K-Factor Rating: Transformers indicated to be K-factor rated are listed to comply with UL 1561 requirements for nonsinusoidal load current handling capability to the degree defined by the designated K-factor.
 - 1. Transformer design prevents overheating when carrying full load with harmonic content corresponding to the designated K-factor.
 - 2. Nameplate states the designated K-factor of the transformer.
- J. Vibration Isolation:
 - 1. Provide neoprene rubber pads to isolate core and coil assembly from transformer enclosure.
- K. Wall-Mounting Brackets: Manufacturer's standard brackets for transformers up to 75 kVA.

2.4 BUCK-BOOST TRANSFORMERS

- A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506 or UL 1561.
- B. Description: Self-cooled dry type, rated for continuous duty, and connected as autotransformers to provide the percentage of buck or boost indicated.

2.5 CONTROL AND SIGNAL TRANSFORMERS

- A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.
- C. Description: Self-cooled, 2 windings.

2.6 FINISHES

- A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.

2.7 SOURCE QUALITY CONTROL

- A. Factory Tests: Design and routine tests comply with referenced standards.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this project if specified sound levels are below standard ratings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with safety requirements of IEEE C2.
- B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.
- C. Anchor transformer securely with minimum ½" diameter bolts. Strength of bolts used to secure the transformer shall be sufficient to resist shear and uplift produced by a force equal to one half of the equipment mass applied horizontally at the center of gravity.
- D. Provide 1" thick resiliency pads to isolate transformer from floor or platform, Korfund "Elasto Rib" or equal.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
- F. The grounding conductor for each transformer shall be routed back to the Main Grounding Bar used for the building ground system.

3.2 GROUNDING

- A. Separately Derived Systems: Comply with the NEC requirements for connecting to grounding electrodes and for bonding to metallic piping near the transformer.
- B. Comply with Section 260526 - Grounding for materials and installation requirements.

3.3 CONNECTIONS

- A. Use flexible conduits at least 24" long for electrical connections.

3.4 IDENTIFICATION

- A. Provide engraved lamacoid nameplate for each transformer.

3.5 FIELD QUALITY CONTROL

- A. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the contract documents, and is suitable for energizing.
- B. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
 - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
 - 2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values.
- C. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.6 CLEANING

- A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.7 ADJUSTING

- A. After installing and cleaning, touch up scratches and mars on finish to match original finish.
- B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit to owner.
- C. Adjust buck-boost transformer connections to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility.

END OF SECTION 262200

SECTION 262416**PANELBOARDS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Distribution panelboards.
- B. Related sections:
 - 1. Section 260501 - Field Test and Operational Check.
 - 2. Section 260526 - Grounding.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- D. Maintenance Data: For panelboards and components, include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with the NEC.

1.5 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Panelboards, Overcurrent Protective Devices and Accessories:
 - a. Cutler-Hammer; Eaton Corporation.
 - b. ABB / General Electric Company; Electrical Distribution & Control Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D; Schneider Electric.
 - e. Or Equal

2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush or surface mounted cabinets (as indicated on drawings). Construct cabinets with code gauge galvanized steel. Provide minimum 20" wide cabinets and extra wiring space where incoming feed-through or parallel lines are shown. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Doors: Provide door-in-door construction, made of cold-rolled steel. Inner door shall provide access to breaker handles and outer door shall provide access to wiring space as well. Inner door shall be completely flush with no visible bolts, screw-heads or hinges and with flush catch and lock. Outer door shall have concealed hinges, flush catch and lock to match inner door, located in line with inner door catch. (Tee bar handles are not acceptable).
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity. Attach circuit breakers to bus so that circuits 1, 3, and 5; 2, 4, and 6, or any three similarly numbered circuits form one three-phase, four-wire circuit.
- G. Main and Neutral Lugs: Compression or mechanical type suitable for use with conductor material.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- J. Isolated Equipment Ground Bus: Where indicated on drawings - Adequate for branch-circuit equipment ground conductors; insulated from box.
- K. Extra-Capacity Neutral Bus: Where indicated on drawings, neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. Where indicated on plans, On 120/208Y Panels fed by K factor Type Transformer.
- L. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor. Where indicated on plans.
- M. Gutter Barrier: Arrange to isolate individual panel sections.
- N. Feed-through Lugs: Compression or mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. For two-section panels.
- O. Panels located adjacent to each other shall have identically sized enclosures and trims.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating. If not series rated: Fully rated to interrupt symmetrical short-circuit current available at terminals or the rating indicated on the plans, whichever is higher.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices:
 - 1. 120/208Y Volt branch circuit panelboards: Molded case bolt-on type designed for 277/480Y volt, three-phase, four-wire service with minimum 10,000 amperes rms short circuit rating.
 - 2. 277/480Y Volt branch circuit panelboards: Molded case bolt-on type designed for 277/480Y volt, three-phase, four-wire service with minimum 14,000 amperes rms short circuit rating.
 - 3. Provide multi-pole units with common trip elements.
 - 4. Breakers shall have center-tripped position in addition to the ON and OFF positions.
 - 5. Provide lockouts for all circuits that should not be inadvertently tripped (as indicated on the drawings).

2.5 DISTRIBUTION PANELBOARDS

- A. Dead-front, dead-rear, Nema 1 or 3R enclosure as indicated, designed for use on a three-phase, four-wire, 120/208Y or 277/480Y volt system. See drawings for additional details.
- B. Construction: Code gauge galvanized steel fully flanged for strength and rigidity. Door and trim shall be cold-rolled steel, code gauge. Provide concealed butt hinges and 3-point catch and lock. Provide separately hinged or bolted vertical access doors over lug and wiring spaces.
- C. Bus Bars: Panel shall be fully bussed. Shall be used throughout and shall be hard-rolled, electrolytic copper of 98% conductivity designed for a maximum 1000 amperes per square inch. Bars shall be factory pre-drilled to accept future field installation of 2 or 3 pole circuit breakers in any combination. Brace all bus bars for required short circuit rating of the panel, but in no case less than 35,000 amperes rms, Refer to Short Circuit information above for additional requirements.
- D. Main Overcurrent Protective Devices: Circuit breaker unless otherwise noted.
- E. Provide handle locking devices for all circuit breakers.
- F. Provide engraved nameplates with minimum 1/4" high letters secured to panel front and for each circuit protective device in panel.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Main Breaker (or Feeder) Assemblies rated for 1200 Amps:
 - 1. Main (or feeder) breakers rated for 1200 Amp may be Molded Case with temperature insensitive, solid state trips, current sensors and solid state logic circuit integral with the frame. All circuit breakers shall be of same design for over-current and ground fault trip coordination. The Circuit breakers shall have the following features:
 - a. UL listed for 80 percent load application unless otherwise indicated on plans as 100% rated.
 - b. Adjustable [L] Long time time-delay and ampere setting.
 - c. Adjustable [S] Short time-delay and pick-up.
 - d. Adjustable [I] Instantaneous trip.
 - e. For 277/480Y systems rated 1000 Amp or higher - Adjustable [G] Ground fault pick-up and delay is required.
 - f. Adjustable [G] Ground fault pick-up and delay where indicated or required by NEC.
 - g. Adjustable [R] Reduced Energy Let-Through (RELT) Instantaneous trip. This feature shall be provided on breakers to provide a temporary setting for the instantaneous trip setting of the breaker. Setting shall be adjustable down to 1.5X of the rating plug and shall be enabled through a switch mounted on front of the switchboard. The

- switch shall be combined with an indicating light that positively indicates that the RELT is enabled or disabled.
- h. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard.
 - i. Short circuit, overload and ground fault trip indicators.
 - C. Feeder Circuit Breaker Assemblies 400 Amps or larger:
 - 1. Feeder Circuit breakers 400 Amps or larger shall be digital solid state true RMS sensing Molded Case Circuit Breakers with temperature insensitive, solid state trips, current sensors and solid state logic circuit integral with the frame. All circuit breakers shall be of same design for over-current and ground fault trip coordination. The Circuit Breakers shall have the following minimum features:
 - a. UL listed for 80 percent load application unless otherwise indicated on plans.
 - b. Long time pickup (ampere setting) determined by interchangeable rating plug .
 - c. Adjustable instantaneous with short time tracking function.
 - d. Circuit Breaker shall allow the UL listed field installation internal accessories (Auxiliary Switch, Shunt Trip, Undervoltage release, Bell Alarm Switch) without removal of cover to install. Circuit Breaker shall include Accessories as indicated on plans.
 - e. Circuit breaker handle accessories shall provide provisions for locking handle in the 'ON' or 'OFF' position
 - 2. Where specifically indicated or required by NEC
 - a. Adjustable [L] Long time time-delay and ampere setting.
 - b. Adjustable [S] Short time-delay and pick-up.
 - c. Adjustable [I] Instantaneous trip.
 - d. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
 - e. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard
 - f. Short circuit, overload and ground fault trip indicators.
 - h. Trip device of circuit breakers shall be of same type for tripping coordination.
 - D. Feeder Circuit Breaker Assemblies 150 Amp and below:
 - 1. Feeder Circuit breakers 150 Amp and below shall be thermal Magnetic Circuit breaker: Inverse time current element for low level overloads, and instantaneous magnetic trip element for short circuits, unless otherwise indicated or required to meet Section 2.4 C above. Minimum features below:
 - a. UL listed for 80 percent load application unless otherwise indicated on plans.
 - b. Circuit Breaker shall allow the UL listed field installation internal accessories (Auxiliary Switch, Shunt Trip, Undervoltage release, Bell Alarm Switch) without removal of cover to install. Circuit Breaker shall include Accessories as indicated on plans.
 - c. Circuit breaker handle accessories shall provide provisions for locking handle in the 'ON' or 'OFF' position
 - 2. Where specifically indicated or required by NEC
 - a. Adjustable [L] Long time time-delay and ampere setting with Long time pickup (ampere setting) determined by interchangeable rating plug.
 - b. Adjustable [S] Short time-delay and pick-up.
 - c. Adjustable [I] Instantaneous trip.
 - d. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
 - e. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard
 - f. Short circuit, overload and ground fault trip indicators.
 - h. Trip device of circuit breakers shall be of same type for tripping coordination.
 - E. General Breaker Requirements:

1. Minimum interrupting capacity shall match the minimum required interrupt rating of the panel.
2. Standard frame sizes, trip ratings, and number of poles.
3. Lugs: Mechanical or compression style, suitable for number, size, trip ratings, and material of conductors.
4. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
5. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
6. Shunt Trip: 120-V trip coil energized from separate circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Clearances: Minimum code required clearances around panelboards must be maintained.
- C. Mounting Heights: Top of trim 78 inches above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Mounting Hardware: Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column or other parts of building structure.
- F. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- G. Install filler plates in unused spaces.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components.
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Label shall include panel designation, voltage and phase in minimum 1/4" high letters.

3.3 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.4 FIELD QUALITY CONTROL

- A. Testing: Refer to Section 260501 – Field Test and Operational Check.
- B. After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements
 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balancing Loads: After Substantial Completion, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit breaker trip ranges.
- B. Adjust all operating mechanisms for free mechanical movement.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726**WIRING DEVICES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Receptacles
 - 2. Connectors
 - 3. Switches
 - 4. Finish Plates
- B. Related Sections:
 - 1. Section 00 31 13.43 - Interior Finish Index
 - 2. Section 26 05 53 - Identification for Electrical Systems.

1.2 DEFINITIONS

- A. Refer to Division 26 Section 26 05 00 – Common Work Results for Electrical for applicable definitions.

1.3 SUBMITTALS

- A. Product Data: For each type of device, including dimensions, finishes, electrical ratings, and installation instructions
- B. Samples: Provide color samples of device plates if not specified by manufacturer standard.
- C. Field Quality Control Reports: As specified in Part 3.
- D. Operation and Maintenance Data: Include in project closeout documents per Section 01 78 23

1.4 QUALITY ASSURANCE

- A. Products Listed and Labeled: Provide wiring devices listed and labeled by a Nationally Recognized Testing Laboratory (NRTL).
- B. Comply with NFPA 70 (National Electrical Code).
- C. Manufacturer Qualifications: Minimum 5 years' experience producing specified products.

1.5 COORDINATION

- A. Coordinate device types and mounting heights with architectural drawings and equipment locations.
- B. Refer to Section 00 31 13.43 for device finish requirements per room type.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. F Store wiring devices in original packaging until installation.
- B. Protect devices from dirt, moisture, and damage during construction.

PART 2 - PRODUCTS**2.1 RECEPTACLES**

- A. Straight Blade and Locking-Type Receptacles:
 - 1. NEMA 5-20R duplex type, general-duty grade.

- B. GFCI Receptacles:
1. Feed-through type with integral duplex receptacle, NEMA WD 6, Configuration 5-20R.
 2. Designed for installation in 2-3/4-inch-deep outlet boxes without adapters.
- C. Isolated-Ground Receptacles:
1. Grounding contacts connected only to device ground screw; isolated from mounting strap.
 2. Devices listed and labeled for isolated-ground use.
 3. The isolation method shall be integral, not reliant on removable parts.
- D. D. Approved Manufacturers and Product Types:
1. Standard Receptacles

<u>Manufacturer</u>	<u>Receptacles</u>	<u>GFCI Receptacles</u>	<u>Surge Receptacles</u>
Cooper Wiring Devices	5362	GF15A/XGF15A	5250/1208
Hubbell	5362	GF5262	5262S
Leviton	5362	6598	
Pass & Seymour	5362	1597-I	

2. Tamper Resistant, Weather-Resistant, GFCI Receptacles

<u>Manufacturer</u>	<u>15A Receptacles</u>	<u>20A Receptacles</u>
Cooper Wiring Devices	TWRVGF15W	TWRVG20W
Hubbell	GFTR15W	GFTR20W
Leviton	W7599-TW	W7899-TW
Pass & Seymour	1597TRWRW	2097TRWRW

- E. Weatherproof Covers (In-Use Type) -
1. Approved Manufacturer -
 - a. TayMac MX3200 Extra Heavy Duty
 - b. Intermatic WP3110MXD, WP1030MXD, WP1010MXD, WP1010HMXD
 - c. Engineer-approved equal

2.2 Toggle Switches

- A. Snap Switches: General-duty, quiet operation typ.
- B. Combination Switch/Receptacle Units:
1. 20A, 120/277 VAC switch; 5-15R receptacle.
 2. Single gang with plaster ears and removable tab connectors for split wiring.
- C. Approved Manufacturers and Product Types:

<u>Manufacturer</u>	<u>15A Switches</u>	<u>20A Switches</u>	<u>15A Three-Way Switches</u>
Cooper Wiring Devices	1201	AH1221	1203
Hubbell	HBL1201	HBL1221	HBL1203
Leviton	1201	1202	1203
Pass & Seymour	15AC-1	20AC-1	15AC-3

- D. Multi-Gang Switches:

1. Gang switches under one plate unless space constraints require interchangeable types.
2. Alternate configurations require Owner's Representative approval.

- E. Occupancy Sensors:
 1. See Control Schedule on Drawings
- F. Dimmer Switches:
 1. See Control Schedule on Drawings

2.3 WALL PLATES

- A. Match configuration of installed devices.
- B. Screws: Metal with finish to match plates.
- C. Material:
 1. Smooth urea plastic (standard areas).
Steel (equipment spaces).
Stainless steel (kitchen areas).
In-use rated weatherproof (outdoor).
 2. Color:
Coordinate and provide in accordance with ISU standards.

2.4 FLOOR SERVICE FITTINGS

- A. See Details on Drawings.

2.5 POKE-THROUGH ASSEMBLIES

- A. See Details on Drawings.

2.6 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Wire: No. **12 AWG**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices plumb and securely.
- B. Protect devices during painting; install plates post-finishing
- C. Derate dimmers per manufacturer instructions when ganged.
- D. Do not share neutrals on dimmer load sides.
- E. Mount receptacles with ground terminal up; switches vertical unless noted.
- F. Coordinate exact locations with partition and furniture layouts.
- G. IDENTIFICATION
- H. Comply with Section 26 05 53 "Identification for **Electrical Systems**."
 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
 2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.2 IDENTIFICATION

- A. Comply with Section 26 05 53.
- B. Labeling:

1. Switches (3+ gang): Engraved legends
2. Receptacles: Label with panelboard and circuit number.

3.3 CONNECTIONS

- A. Connect device ground terminals to branch circuit ground.
- B. Isolated grounds to be run to designated isolated grounding points.
- C. Torque all connectors per manufacturer or UL 486A/B standards.

3.4 FIELD QUALITY CONTROL

- A. Test devices for polarity, continuity, and function.
- B. Verify surge-protection indicators.
- C. Test GFCIs using local and remote fault simulators
- D. Replace defective units

3.5 CLEANING

- A. Test devices for polarity, continuity, and function.
- B. Verify surge-protection indicators.
- C. Test GFCIs using local and remote fault simulators
- D. Replace defective units
- E. Cleaning
- F. Clean internally; replace stained or damaged plates/devices.

END OF SECTION 262726

SECTION 262815**DISCONNECT SWITCHES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 WORK INCLUDED

- A. Provide and install motor disconnects.
- B. Provide and install circuit disconnects.

1.3 REFERENCES

- A. Underwriters' Laboratory, Inc. - Annual Product Directories.
- B. NEMA - Classification of Standard Types of Nonventilated Enclosures for Electric Controllers.

1.4 REGULATORY REQUIREMENTS

- A. Conform to National Electrical Code and to applicable inspection authority.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Cutler-Hammer/Westinghouse, General Electric, Siemens, Square D, or approved equal.

2.2 COMPONENTS

- A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.
- B. Single Phase 120 Volt Disconnect Switches: Single pole toggle switch with thermal overload motor protection where indicated. A Horse Power rated switch may be used where fractional horse power motors have internal overload protection.
- C. Single or Three Phase Motor Disconnect Switches: two or three pole heavy duty or fusible where other loads are on same circuit, 250 or 600 volt as required in NEMA Type 1, 3R, or 4 enclosures designed to reject all except Class 'R' fuses.

2.3 ACCEPTABLE MANUFACTURERS - FUSES

- A. Cooper Bussmann, Edison, Littelfuse, Ferraz Shawmut, or approved equal.

2.4 FUSES

- A. As indicated on the drawings. All shall be of the same manufacturer. Provide one spare set of fuses (minimum of three) for each current rating and type used. See Section 262813.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install motor and circuit disconnect as indicated on Drawings and as required by Code. Where fuses are indicated, provide fuses correlated with full load current of motors provided.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs where indicated on drawings.

- B. Identify panelboard and circuit number from which served, and the identification of the equipment served by the disconnect. Label the outside of each exterior mounted disconnect with an engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Label outside each interior mounted disconnect with machine-printed, pressure-sensitive, abrasion-resistant label tape. Labels shall be Brother 1/2" TZ tape, black ink on clear, extra-strength adhesive tape, with size 18 text or engineer approved equal.

END OF SECTION 262815

SECTION 265100**INTERIOR LIGHTING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Interior Lighting Fixtures
 - 2. Drivers
 - 3. Exit Signs
 - 4. Accessories

1.2 REFERENCES

- A. American National Standards Institute (ANSI) Publications:
 - 1. ANSI/IES LM-85-23: Measurements of LED Sources
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE) Publications:
 - 1. C62.41 "Surge Voltages in Low-Voltage AC Power Circuits"
- C. National Fire Protection Association (NFPA) Publications:
 - 1. NFPA 70 "National Electric Code"
 - 2. NFPA 101 "Life Safety Code®"

1.3 PRIOR APPROVAL

- A. General:
 - 1. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Engineer and are specifically approved by the Engineer, in writing, 7 days prior to closing of bid.
 - 2. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:
 - 1. For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - a. Dimensions of fixtures.
 - b. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 - c. Emergency lighting unit battery and charger.
 - d. Photometric data.
 - 2. Dimming Compatibility Certificates: Signed by manufacturer of driver certifying that drivers are compatible with dimming systems and equipment with which they are used.
 - 3. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - 4. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 01.

1.5 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

PART 2 - PRODUCTS

2.1 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Approved Manufacturers:
 - 1. Subject to compliance with requirements, provide the products indicated for each designation in Lighting Fixture Schedule as shown on drawings.
 - 2. All alternate light fixture packages shall be submitted a minimum of 7 days prior to bid for approval.
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and when secured in operating position.
- E. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 90 percent.
 - 2. Specular Surfaces: 95 percent.
 - 3. Diffusing Specular Surfaces: 85 percent.
- F. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
 - 2. Lens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

2.2 LED LIGHTING FIXTURES

- A. General Requirements:
 - 1. See lighting fixtures schedule for specifications.

2.3 FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260500 "Basic Electrical Materials and Methods," for channel- and angle-iron supports, and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish the same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish the same as fixture.
- D. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturers.

2.4 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.
 - 3. Colors as indicated in Light Fixture Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings:
 - 1. Recessed lighting fixtures shall be supported independently from the suspended ceiling system. Number 8-gauge galvanized steel wire or approved type hangers from the overhead building structures shall be provided for fixture support.
- C. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

3.2 CONNECTIONS

- A. Ground Equipment:
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: As follows:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Report results in writing.
- E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- F. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufactures.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 265100

SECTION 281300 – STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This document is general in nature and not specific to a particular project. It is, however, the minimum standard by which all construction documents, particular to any telecommunications project, should be based. Any modifications to this document to fit a particular project must be approved by NetCom prior to being put in a construction document.
- B. This specification may impact on other trades. When there is a conflict in the construction document between trades, this General Structured Cabling Minimum Specification prevails.
- C. As an example, the construction document may instruct the electrical contractor to provide telecommunications grounding/bonding and conduit runs in the electrical section of the construction document. If there is a conflict between the electrical specification and the telecommunications specification, the telecommunications specification prevails.

1.2 STANDARDS

- A. Building structured wiring systems shall meet the following:
 - 1. Idaho State University (ISU) cabling conventions.
 - 2. Networking & Telecommunications Department (NetCom)
 - 3. Building Industry Consulting Service International (BICSI)
 - 4. Telecommunications Distribution Methods Manual (TDMM 13th Edition)
 - 5. Current ANSI/TIA/EIA Telecommunications Building Wiring Standards
 - 6. National Electrical Manufacturer's Association (NEMA) NEMA WC 26
 - 7. National Electrical Code 2017 NFPA 70 manuals as adopted by ISU
- B. Bidder Qualifications as outlined in the Telecommunications contractor qualifications
 - 1. Fully acquainted with the above referenced standards
 - 2. Fully qualified with the above referenced standards
 - 3. Manufacturer authorization, qualifications and certifications to:
 - a. Install Category 6/6A (CAT 6/6A) Ortronics/Superior Essex nCompass 1G Channel Solution and 1000BaseTX/FX intra-building backbone.
 - b. Test a Category 6/6A (CAT 6/6A) Ortronics/Superior Essex nCompass 1G Channel Solution and 1000BaseTX/FX intra-building backbone.
 - 4. The network cabling infrastructure must be installed by
 - a. Manufacturer approved designers
 - b. Certified contractors at one of the following:
 - 1) Certified Installer Plus-Enterprise Solutions Partner (CIP-ESP) tier
 - 2) Certified Installer Plus (CIP) tier in accordance with manufacturer's installation instructions and specifications.
- C. Testing
 - 1. All station and riser cabling shall be tested and certified by successful bidder to support 1000BaseTX/FX technology.

1.3 TELECOMMUNICATIONS CONTRACTOR QUALIFICATIONS

- A. ISU requirements:
1. Only qualified and experienced Telecommunications contractors perform design, project management, and installation services in the construction of the ISU structured cabling infrastructure.
 2. Pursuant to this, ISU wants to ensure that successful contractors have the manufacturer authorization, capabilities, qualifications, financial stability, and experience to complete Telecommunications installations using common industry practices (i.e. BICSI TDDMM, ANSI/TIA/EIA, NEMA, NFPA, etc) while meeting all requirements of this specification.
- B. A contractor, by responding to a bid, represents that their company possesses the manufacturer authorizations, qualifications, certifications, capabilities, test equipment, expertise, and personnel necessary to provide an efficient and successful installation of properly operating components, as specified.
- C. Bidder must meet the requirement:
1. Of having continuously performed Telecommunications installation work for a period of at least five (5) years.
 2. The Telecommunications contractor must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-ESP).
 3. A copy of certification documents must be submitted prior to construction in order for such bid to be valid.
 4. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CIP Program.
 5. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under the Ortronics CIP Program.
 6. At least 30 percent of the copper installation and termination crew must be certified by BICSI and Ortronics, with a BICSI Technician Certification.
- D. Bidder is required to
1. Carefully consider the amount and character of the work to be done, as well as the difficulties involved in its proper execution.
 2. Bidder should include in their bid all costs deemed necessary to cover contingencies essential to successfully installing the specified system.
 3. Any cost not specifically itemized in the proposal shall not be incurred unless specifically agreed upon by all parties and documented in writing.
 4. No claims for compensation will be considered or allowed for extra work resulting from lack of knowledge of any existing conditions on the part of the bidder.
- E. ISU requires references from projects of a similar size and nature. Names of the officers of the company and resumes of those to be assigned to the project, including subcontractors, must be provided. Telecommunications contractor shall, at all times during performance of work, and until work is completed and accepted, have on the premises a competent supervisor satisfactory to ISU and with authority to act for the Telecommunications contractor regarding work schedules and any changes to the scope of work. The supervisor must be a BICSI certified Technician and a BICSI member in good standing.
- F. As a requirement to bidding and performing awarded work, Telecommunications contractor shall have:
1. Currently trained registered and certified BICSI Technicians and at least (1) Registered Communication Distribution Designer (RCDD) on staff.
 2. A copy of the RCDD certifications and BICSI member number must be

provided prior to construction.

- G. Telecommunications contractor must provide at least one project manager or lead technician on site at all times during project whom is a BICSI trained, certified, and registered Technician and a BICSI member in good standing. A copy of certificate and BICSI member number must be provided prior to construction. Inspections and approval of all work performed shall be conducted by an ISU supplied BICSI Registered Communications Distribution Designer (RCDD).
- H. Telecommunication contractor must be skilled and proficient in both inside cable plant (copper and fiber optics) installation, as well as outside cable plant (copper and fiber optics) installation, termination, splicing, and testing. Telecommunications contractor must be certified by the manufacture of the structured cable system specified in this document. (See 1.5 Materials)

1.4 PROGRESS MEETINGS

- A. The successful bidder will be required to:
 - 1. Meet with and coordinate with a representative of ISU NetCom to ensure work is meeting ISU conventions and standards.
 - a. Prior to work beginning
 - b. A minimum of weekly during the installation process.
 - c. Meetings may include a site inspection to ensure compliance with the defined standards contained in this document.
 - d. The successful electrical and telecommunications contractor(s) shall follow appropriate installation guidelines, as contained in the most currently available BICSI TDM, ANSI/TIA/EIA, NEMA WC 26, and NFPA 70 manuals.
 - e. Contractor will work with ISU NetCom to ensure proper placement and routing of cable and support hardware.
 - f. The specified Structured Cable Wiring Standards are to be used as a minimum requirement.

1.5 DOCUMENTATION

- A. Prior to system acceptance, the successful bidder shall submit to the owner:
 - 1. Fully documented 8.5" x 11" scale drawings of the entire fiber optic and copper distribution system.
 - 2. Documentation shall be provided in both a hard copy binder and a digital copy capable of being viewed and edited in MS Visio.
 - 3. This will include building and floor layouts with appropriate labeling and locations of:
 - a. workstation Telecommunications Outlet (TO)
 - b. Equipment Room/Telecommunications Room (ER/TR)
 - c. Main Cross Connect/Intermediate Cross Connect (MC/IC)
 - d. cable routes
 - e. interconnect locations
 - f. riser locations
 - g. all other information pertinent to the installation.
- B. Successful bidder will be responsible for accurately labeling and identifying all relevant components of the cabling system, including, but not limited to:
 - 1. Telecommunications Outlet (TO) face plate labeling
 - 2. patch panel and block labeling and color-coding
 - 3. backbone cable labeling at entrance to MC, BEF/IC/ER, and HC/TR

4. fiber optic patch panel labeling and color-coding, cables at each end, conduits at each end, and grounding system.
5. Reference BICSI TDMM, 13th Edition, Telecommunications Administration. The successful bidder will consult with ISU NetCom's representative in regard to labeling and identification.

1.6 MATERIALS

- A. Idaho State University has selected the Ortronics/Superior Essex nCompass Structured Cabling Solution for all campus cabling. ISU desires to protect it's investment in training, certifications, and inventory, therefore, all new construction and remodel projects shall include the Ortronics/Superior Essex nCompass Cabling Solution products as specified.
- B. The Telecommunications contractor must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-ESP). A copy of certification documents must be submitted prior to construction for such bid to be valid.
- C. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CIP Program. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under the Ortronics CIP Program. At least 30 percent of the copper installation and termination crew must be certified by BICSI and Ortronics, with a BICSI Technician Certification.
- D. Bidder should expect to present quotes based on the following itemized manufacturer's products. The horizontal workstation structured cabling system shall be an Ortronics/Superior Essex nCompass Cat 6/6A U/UTP Channel Solution. Bidder shall be authorized and certified, by the manufacturer's representative, to install, certify and warranty the structured cabling system. The specified Ortronics/Superior Essex nCompass channel solution is not substitutable. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under Ortronics CIP Program.
- E. Horizontal Work Station Cable-
 1. Superior Essex Series 77 CAT 6, POP Box, CMP, Category 6, 4 twisted pair, 23 AWG, FEP, Station Wire for Plenum air return systems.
- F. Wireless Access point location Cable-
 1. Superior Essex 10 Gain CAT 6A, POP BOX, CMP, Category 6A, 4 twisted pair, 23AWG, FEP, Station Wire for Plenum air return systems.

Flame Rating	Jacket	Color	Part No.
CMP Plenum	PVC Alloy	Blue	Cat6-- 77-240-2B Cat6A-- 6A-272- 2B

		Light Gray	Cat6—77-240-3B

NOTE: Irrespective of air handling space, ISU requires the use of CMP Plenum rated cable for smoke and fire mitigation.

- G. Intra-Building Backbone Cable-
Superior Essex Power Sum CMP, 51-478-48, Category 5e, 25 twisted pair, 24 AWG, FEP, Riser Cable for Plenum riser systems.
- H. Corning fiber optic riser cable to TR/HC, (12) strand single-mode, MIC, TBII tight buffer tube construction, FEP.
- I. Workstation Telecommunications Outlet (TO)-

Description	Part No.
Ortronics HDJack Cat 6	HDJ6-13 Ivory Jack
Ortronics HDJack Cat6	HDJ6-36 Dark Blue Jack
Ortronics HDJack Cat6A	HDJ6A-00 Black Jack
Ortronics HD Face Plate	406HDJ13-13 3-Port Wall Plate
Ortronics HD Blank Modules (Pk of Twenty)	OR-HDJB20 Ivory Blank

- J. IC/HC ER/TR Patch Panel Data Termination-

Description	Ports	Part No.
Ortronics HD modular patch panel	24	OR-PHDHJU24
	48	OR-PHDHJU48

- K. Patch Cords-

Description	Length	Part No.
CAT6 Blue, 4-pair	3 ft.	OR-MC603-06
	5 ft.	OR-MC605-06
	7 ft.	OR-MC607-06
	9 ft.	OR-MC609-06
	15 ft.	OR-MC615-06
	20 ft.	OR-MC620-06

CAT6A Blue, 4-pair	25 ft.	OR-MC625-06
	3 ft.	OR-MC6A03-06
	5 ft.	OR-MC6A05-06
	7 ft.	OR-MC6A07-06
	9 ft.	OR-MC6A09-06
	15 ft.	OR-MC6A15-06
	20 ft.	OR-MC6A20-06
	25 ft.	OR-MC6A25-06

L. IC/HC ER/TR 110 Block Voice Termination-

Description	Part No.
100-pair wall mount 110 Field Termination Block with (20) 110C4 and (4) 110C5 connecting blocks and snap-on label designation field.	OR-110ABC5E100
110C5 Connecting Blocks, five-pair, Pk of ten.	OR-30200110

M. Outside Cable Plant and Termination-

Copper and fiber optics pair/strand count, composition and termination to be specified by ISU NetCom per specific project. See 2.2

N. BEF/IC/HC ER/TR Fiber Optic Cabinet and Termination-

1. For Hubbell Next Frame Rack Installations:
 - a. Corning CCH-04U Fiber Distribution Center 72/288 fiber optic enclosure.
 - b. Corning CCH-CP12-A9 Single-Mode LC connector 12 strand pre-loaded panel.
2. For Hubbell RE4X Cabinet Installations:
 - a. Corning SPH-01P 12-Fiber wall panel with LC connectors
 - b. Corning CCH-CP12-A9 Single-Mode LC connector 12 strand pre-loaded panel.

O. Grounding and Bonding-

1. Chatsworth Products 40153-012 12" TMGB Pattern ANSI/EIA/TIA Grounding busbar.

P. Equipment Racks and Cabinets-

1. For Standard Equipment and Telecommunications Room Installations:
 - a. Hubbell Next Frame 19" x 7' Equipment rack with 6" Vertical Organizer - 6" wide Z Channel and cover and Horizontal Cable Management. Black finish.

2. For Computer Labs, corridors and/or Zone Installations:
 - a. Hubbell RE4X REBOX® Commercial Cabinet, 42.2"H x 24.2"W x 10"D, Light Gray, Pre- Configured.
- Q. Outside Cable Plant and Termination-
 1. Copper and fiber optics pair/strand count, composition and termination as specified by ISU NetCom:
 - a. Building Entrance Terminals (Rack Mount): CircaMax 1880ENA1/NSC-200
 - b. Building Entrance Terminals (Wall Mount): CircaMax 1880ENA1/NSC-100
 - c. Building Entrance Terminals (Wall Mount): CircaMax 1880ECA1-25
 - d. Surge Protection Modules: Circa Telcom : 4B1E
 - e. Pressurized Closure System 2 Type 505 Endplate: Corning 80611037229
 - f. Outside Plant Copper 12 Strand: Superior Essex RDUP PE-89 09-094-02
 - g. Outside Plant Copper 25 Strand: Superior Essex RDUP PE-89 09-097-02
 - h. Outside Plant Copper 50 Strand: Superior Essex RDUP PE-89 09-104-02
 - i. Outside Plant Copper 100Strand: Superior Essex RDUP PE-89 09-108-02
 - j. Outside Plant Copper 200 Strand: Superior Essex RDUP PE-89 09-110-02
 - k. Splice Closure Fiber (SCF): Corning SCF-62CC-01-72
 - l. Fiber Optic Cable Loose Tube 144 Strand: Corning 288EU4-T4701D20
 - m. Fiber Optic Cable Loose Tube 144 Strand: Corning 144EU4-T4701D20
 - n. Fiber Optic Cable Loose Tube 144 Strand: Corning 072EU4-T4701D20
 - o. Fiber Optic Cable Loose Tube 48 Strand: Corning 048EU4-T4701D20
 - p. Fiber Optic Cable Loose Tube 24 Strand: Corning 024ZU4-T4F22D20
 - q. Fiber Optic Cable Loose Tube 12 Strand: Corning 012ZU4-T4F22D20
 - r. Fabric Innerduct (Detectable): MaxCell MXED86383
 - s. In Ground Junction Termination Boxes Tier 22: Oldcastle PC4848-48 with "communications" label on cover.
- R. BEF/IC/HC ER/TR Fiber Optic Cabinet and Termination-
 1. For Hubbell Next Frame Rack Installations:
 - a. Corning CCH-04U Fiber Distribution Center 72/288 fiber optic enclosure.
 - b. Corning CCH-CP12-A9 Single-Mode LC connector 12 strand pre-loaded panel.
 - c. Corning CCH-CS12-B3-P00RE Single-Mode (OS2) LC connector 12 strand.
 - d. Corning CCH-CS24-B3-P00RE Single-Mode LC connector 24 strand.
 2. For Hubbell RE4X Cabinet Installations:
 - a. Corning SPH-01P 12-Fiber wall panel with LC connectors
 - b. Corning CCH-CP12-A9 Single-Mode LC connector 12 strand pre-loaded panel.
- S. Grounding and Bonding.-
 1. Chatsworth Products 40153-012 12" TMGB Pattern ANSI/EIA/TIA Grounding busbar.
- T. Equipment Racks and Cabinets

For Standard Equipment and Telecommunications Room Installations:

1. Hubbell Next Frame 19" x 7' Equipment rack with 6" Vertical Organizer - 6" wide Z Channel and cover and Horizontal Cable Management. Black finish.

For Computer Labs, corridors and/or Zone Installations:

2. Hubbell RE4X REBOX® Commercial Cabinet, 42.2"H x 24.2"W x 10"D, Light Gray, Pre- Configured.

U. Other-

1. Panduit HLT21-XO Black Velcro 8" Tie Wrap, 10 pack.
2. ERICO, Inc., CADDY CableCat Fasteners ("J" Hooks).
3. Carlon CF4X1C-5200 corrugated FEP orange inner duct.

1.7 CABLE PLANT

A. EQUIPMENT AND TELECOMMUNICATIONS ROOM REQUIREMENTS

1. Each BEF/IC/ER and HC/TR shall be a stand-alone wiring closet located centrally such that no single UTP horizontal cable run shall exceed 90 meters, when terminated at each end, nor shall horizontal cable runs span floors. There shall be a minimum of one (1) ER/TR per floor in a multi level building. BEF/IC/ER and HC/TR shall not be co-located in custodial, mechanical or other shared space where damage to critical electronics may occur. Each room shall be sized according to use, and meet the below listed criteria. Coordinate with a representative of ISU NetCom prior to installation of backboard, grounding and bonding system, and electrical service.
2. Each BEF/IC/ER shall have a minimum of (2) 4" inside diameter EMT conduits run to each HC/TR. Each conduit shall have (3) 1" corrugated inner-duct installed. (See Conceptual Conduit and Riser drawing at the end of this document)
3. No right angle bends or LBs allowed. 60 degree sweep maximum allowed.
4. Fiber optic cable must be ran in innerduct unless the fiber is an armored fiber.

B. General Requirements

- 1.
2. Floor Size: BEF/IC/ER 10' x 12' Minimum
3. Floor Size: HC/TR 8' x10' Minimum
4. Floor Surface: Treated concrete or tile.
5. Floor loading: 50 lb/ft² minimum or as required by applicable codes.
6. Ceiling Height: 8.5 ft above finished floor
7. Door Size: 3' wide and 6.7' tall w/1800 swing away from backboards and racks.
8. Wall Lining (backboard): AC-grade 3/4" x 4' x 8' sheets plywood, with no voids, covered on all sides with two coats flat white fire-retardant paint.
9. Lighting: Minimum 500 lux measured at 3' above finished floor
10. Power: Provide (6) dedicated, isolated, non-switched, 4-way, 120Vac 20Amp circuits. Provide (2) dedicated, isolated, non-switched 30Amp twist lock circuits near equipment rack.

C. Grounding and Bonding: Install a contiguous Intra-building grounding and bonding system in compliance with TIA/EIA-607 using a minimum conductor size of 6 AWG to be located on each plywood backboard with Grounding Bus Bar as directed.

D. Security: Unique telecom key separate from building master, custodial, or mechanical. Location: Room shall be located such that no single horizontal workstation cable shall

exceed 90 meters from the TO to the TR/ER termination.

- E. HVAC: Maintain constant temperatures of 640 - 750 F with minimum of one air change per hour. Networking/Telecommunications equipment heat dissipation is estimated at 3000 Watts per hour.
 - 1. $3.7 \times 3000 = 11,100$ BTU per hour.
- F. Fire Protection: As required by applicable codes.
- G. Equipment Rack: 7' x 19" equipment rack with wire management (as specified in materials list) and ladder rack shall be provided and installed as directed.
- H. No Intra or Inter-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as ballasts, generators, fans, motor control units, motors, etc.
- I. The BEF/IC/ER and HC/TR structured cable system shall be constructed using materials as specified in the materials list. Horizontal station cable, riser cables, and fiber optics shall be terminated in the appropriate location on the racking system. Voice cables shall be terminated on the appropriate 110 system. Data cables shall be terminated in the appropriate patch panels. Fiber optics shall be terminated in the appropriate fiber optic termination assembly. Cable termination, order of termination, color-coding, grouping, numbering plan, and labeling shall be performed in accordance with BICSI TDMM Telecommunications Administration and ISU NetCom conventions. Entrance facilities shall be terminated on the backboard with appropriate building entrance protection as specified by ISU NetCom. Riser shall be extended from the backboard building entrance protection panel to the 110 system on the rack. Coordinate with a representative of ISU NetCom prior to installation of BEF/IC/ER and HC/TR distribution and termination hardware.

1.8 ENTRANCE FACILITIES

- A. Outside cable plant facility requirements shall be coordinated with ISU NetCom. A minimum of (2) 4" inside diameter schedule 40 PVC conduits shall be run from the BEF/IC/ER to the designated vault or tunnel system. One of the 4" conduits shall have installed (3) 1" corrugated orange inner-duct. Conduits shall be buried a minimum of 24" from the surface on a foundation of 10" wet sand fill. A metallic locator ribbon shall be installed 12" above and parallel to the conduit. There shall be a minimum horizontal separation of 24" from co-located buried electrical service.
- B. Outside plant requirements are determined per project. At a minimum, contractor shall ensure entrance facilities will support a multi-exchange carrier WAN environment with provisions for (1) DS3 circuit and (25) pair copper facilities with future expansion to OC48 and (100) pair copper facilities.
- C. Grounding and Bonding shall conform to NEC Article 250 and TIA/EIA-607 using a minimum conductor size of 6 AWG.
- D. No right-angle bends or LBs allowed. 60 degree sweep maximum allowed.

1.9 HORIZONTAL WORKSTATION CABLE

- A. Each Workstation Telecommunications Outlet (TO) shall have (1) Category 6 cable.
- B. Each Wireless Access point Telecommunications Outlet (TO) shall have (1) Category

6A cables.

- C. In area where an analog connection is deemed necessary a gray Cat6 cable and Ivory jack shall be installed. This cable should run to the closest TR with a 110/66 block.
- D. The gray cable and ivory jack shall be designated as analog voice and the blue cable, and jack shall be designated for data communications.
- E. Each Computer Lab TO shall have (1) Category 6 cable. The blue cables and jacks shall be designated for data communications.
- F. Each Telecommunications Outlet (TO) shall have (1) jacks in each outlet plate as follows:
Install (1) Blue CAT 6 4-Pair UTP cable terminated at the TO in a Blue RJ45 CAT 6 jack and at the HC/TR in the rack mounted patch panel system.
- G. In Areas where an analog connection is deemed necessary a gray CAT6 4-Pair UTP cable and Ivory CAT6 jack shall be installed. This cable should run to the closest TR with a 110/66 block.
- H. Each Wireless Access Point Outlet (TO) shall have (1) jacks in each two-port housing as follows: Install (1) Blue CAT 6A 4-Pair UTP cable terminated at the TO in a Black RJ45 CAT 6A jack and at the HC/TR in the rack mounted patch panel system.
- I. Cables shall be distributed in a horizontal star topology from each TO to the HC/TR. Total terminated length of cable from TO to HC/TR shall not exceed 90 meters total length. Each horizontal cable shall be installed in a "homerun" configuration. No "daisy chained" conduit or cables shall be allowed. No horizontal cable run shall span between floors. A minimum 12" service loop shall be provided at each TO and 24" at each HC/TR.
- J. All cables shall be installed using conduit, cable tray, or "J" hooks. Where cables are not installed in conduit or cable tray, the cable shall not be pulled or installed directly across suspended ceiling tiles or fluorescent lights without proper suspension and consideration of possible electrical interference. If "J" hooks are used, avoid placing any pressure or creating stress points on the cable. Maximum spacing between "J" hooks shall not exceed five feet. Suspended ceiling support wires shall not be used to support cables or cable support system(s).
- K. At no time shall pulling tension exceed 25 lbs. on horizontal cables. Exceeding the maximum recommended pulling tension during installation of cables will compromise wire integrity. If wire integrity is compromised, the wire may not pass testing and certification standards required for a 1000BaseTX infrastructure. The installing contractor will be responsible for replacement of any cable system that does not pass required certification standards. A representative from ISU NetCom may randomly test cable installations during weekly coordination meetings.
- L. Traditional nylon synch style Tie Wraps shall not be used to bundle cables. Only Velcro Tie Wraps are acceptable to bundle cables. Cables shall be dressed in loose, neat bundles.
- M. No Intra-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as ballasts, generators, fans, motor control units, motors, etc.

- N. Horizontal UTP station cable shall be terminated at the HC/TR in a manner that each workstation location will be numbered and terminated in sequential order. Voice (Gray) cable shall be terminated at the 19" x 7' stand-alone rack in rack mounted (or backboard mounted) 110 blocks.
- O. as specified in materials list. Each 100 pair 110 block will support (24) 4-pair cables. Designator strips shall be blue in color. Data (Blue) cables shall be terminated in Ortronics High Density T568A/B wired Patch Panels as specified in materials list and shall be located in 19" x 7' stand alone rack as specified in materials list. Horizontal and vertical fiber optic cable shall be terminated at BEF/IC/ER and HC/TR in Corning fiber optic distribution centers as specified in materials list.
- P. Coordinate with a representative of ISU NetCom prior to installation of BEF/IC/ER and HC/TR distribution and termination hardware.
- Q. Each TO location shall use Ortronics TracJack hardware as specified in materials list. The gray CAT 6 cable shall be terminated in an Ivory HD jack. The Blue and CAT 6 cable(s) shall be terminated TIA/EIA T568A in (1) Blue RJ45 jacks. Stripping of cable jacket, untwisting of conductor pairs and termination shall be done using TIA/EIA conventions. 12" of excess jacketed cables shall be coiled in the outlet box to accommodate future re-termination. Maintain UTP cable pair twists up to the point of termination (maximum of up to 1/4" jacket removal allowed) at both the station/outlet end as well as patch panel/ block end for each horizontal cable. Take caution as to refrain from physically changing or damaging the shape or geometry of the cable during installation, i.e., do not cinch cable ties too tightly; avoid kinks and sharp bends in cable. Do not place bundles in such a way that the weight of large bundles is damaging the cables on the bottom of the bundle. Each TO wall plate shall be numbered sequentially, consistent with the HC/TR number layout using an acceptable labeling system. Coordinate with a representative of ISU NetCom prior to installation of TO termination hardware.
- R. Successful bidders shall test and certify that building wiring meets or exceeds all applicable TIA/EIA 568, 569, 606, 607, etc. conventions and standards. Successful bidders shall test and certify tha building wiring shall support 1000Base TX/FX (gigabit) Ethernet technologies. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under Ortronics CIP Program. All test results shall be supplied at completion of the project.

1.10 VERTICAL RISER CABLE

- A. Install a minimum of (2) 4" conduit paths between the BEF/IC/ER and each HC/TR.
- B. No right angle bends or LBs allowed. 60 degree sweep maximum allowed. Any conduit exceeding 100' shall have a pull box every 100'.
- C. For each (12) telephone workstation locations there shall be a (25) pair copper riser from the HC/TR to the BEF/IC/ER. Copper riser cable shall be of a 25 Pair Category 5E FEP rated construction as specified in materials list. All riser cable shall be terminated using 110 wiring distribution systems as specified in materials list. Riser cable shall be terminated on a separate 100 pair block from horizontal station cable. Designator strips shall be gray in color. Coordinate with a representative of ISU NetCom prior to installation and termination of riser cable and termination hardware.
- D. Each TR/HC shall have a (12) strand single-mode, MIC, TBII tight buffer tube construction. Fiber optic cable shall be terminated in a Corning cabinet at the BEF/IC/ER and each HC/TR. See materials list.

- E. Coordinate with a representative of ISU NetCom prior to installation of fiber optic riser cable.

1.11 PATHWAY SUPPORT SYSTEM

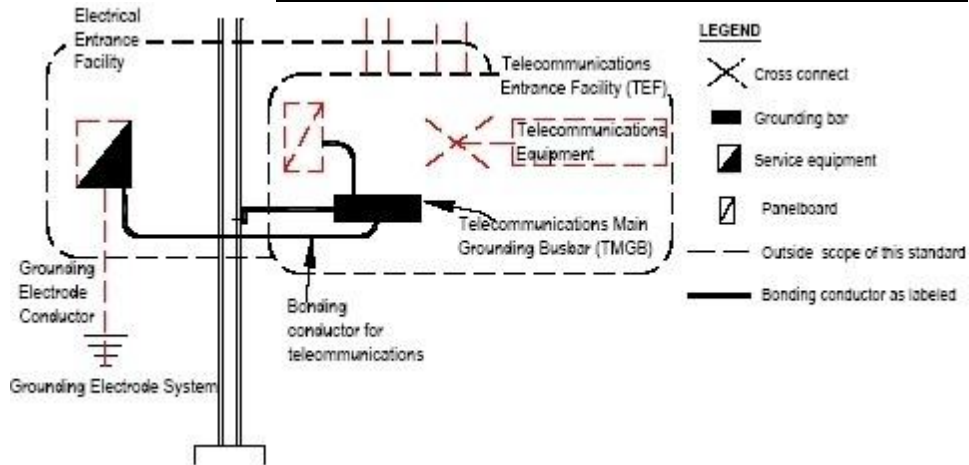
- A. All horizontal cable shall be installed using a home-run configuration. Conduit, cable tray or "J" hooks are acceptable in any combination to support the cable system.
- B. NOTE: In open ceiling environments, where cable is intentionally or unintentionally exposed to view, the cable shall not be painted.
 - 1. Cable should be protected from exposure to paint.
 - 2. Paint products may deteriorate the cable sheath and compromise the integrity of cable conductors.
- C. Conduits shall be dedicated, using no smaller than a 1" inside diameter per workstation outlet. There shall be no daisy-chain conduit runs. Each workstation location shall require one 1" conduit, which is a home run back to the appropriate HC/TR or appropriate tray/support system. Provide pull boxes in telecommunications conduit runs spaced not greater than 100 feet apart with no more than two right angle bends. If more than two bends are in any 100-foot section, increase the conduit by one trade size. See TIA/EIA-569-A Section 4.4. Place a "TELECOMMUNICATIONS" label on all pull and junction boxes. If a cable tray system is installed, the conduit shall be a home run from the workstation outlet jack to the tray. Conduit runs shall not exceed 40% fill capacity and bend design as specified in TIA/EIA-569-A documents. Conduits should be sized appropriately.
 - 1. Workstation conduits shall be dedicated 1:1 ratio of conduit to workstation outlet.
 - 2. Workstation conduits shall not be daisy chained or shared between workstation outlets.
 - 3. Conduit runs shall have no more than (2) right angle bends.
 - 4. Conduit fill shall not exceed 40%.
 - 5. Fiber must be ran in innerduct unless the fiber is an armored fiber.
- D. Traditional nylon synch style Tie Wraps shall not be used to bundle cables. Velcro style Tie Wraps are the only acceptable method to secure cable bundles. See materials list. At no time shall pulling tension exceed 25 lbs on horizontal cables. Exceeding the maximum recommended pulling tension on Category 6/6A cables will compromise cable integrity. If wire integrity is compromised, the wire may not pass testing and certification standards required for a 1000BaseTX infrastructure. The installing contractor will be responsible for replacement of any cable system that does not meet required standards.
- E. No intra/inter-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as generators, motors etc.

1.12 GROUNDING AND BONDING

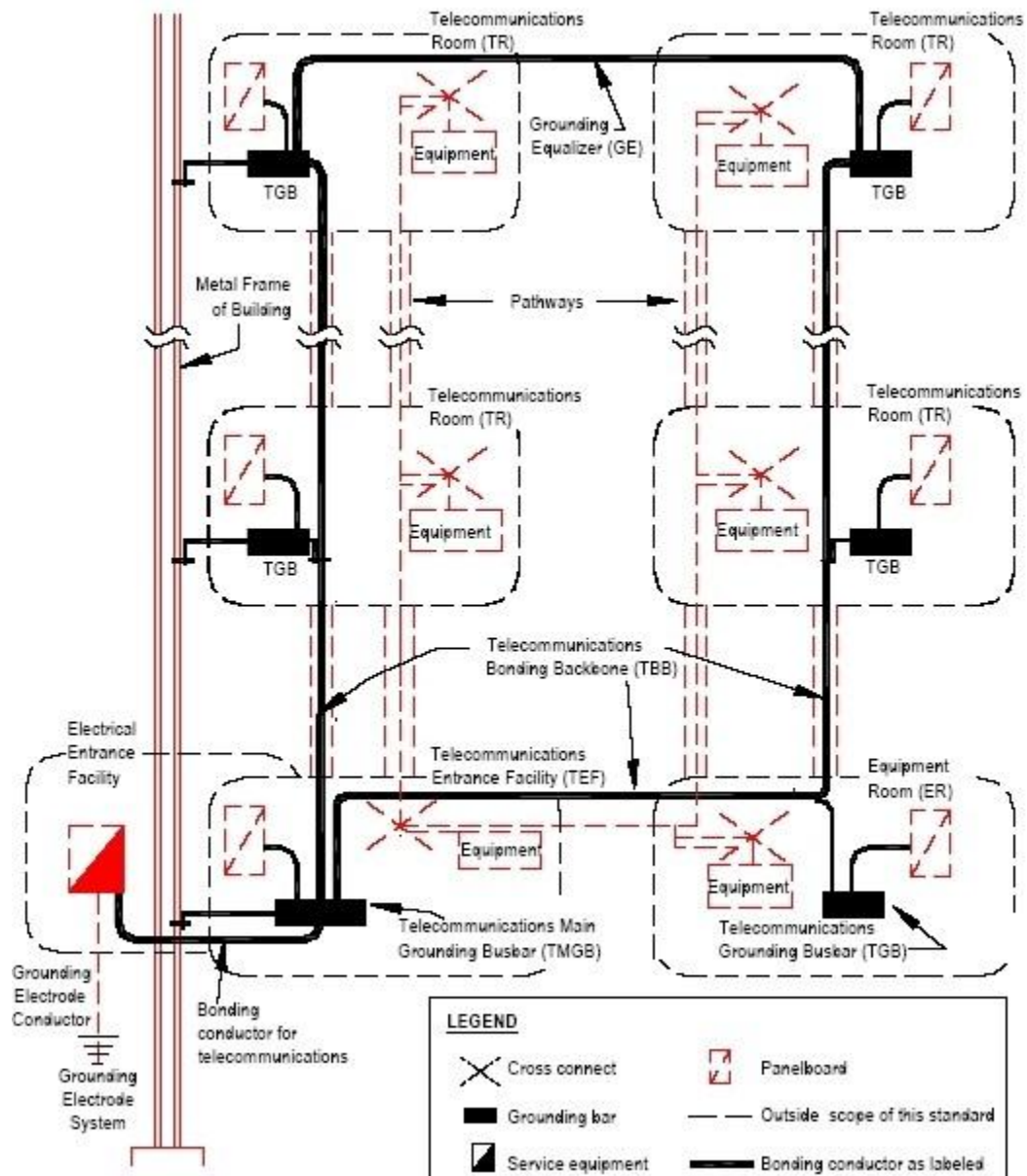
- A. Telecommunications bonding and grounding are additional bonding and grounding installed specifically for telecommunications systems. From a safety code standpoint, the NEC and NFPA 780 already cover such bonding and grounding, however, these codes are established primarily for safety. There are many situations where these codes can be interpreted or implemented in different ways. Some of these ways may not be as suitable as others for equipment protection, reliability, and performance.

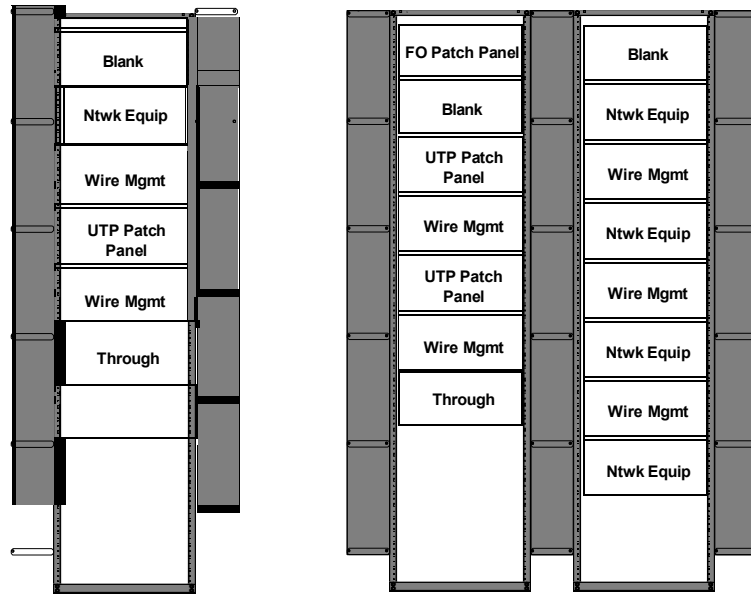
- B. Establishing a suitable telecommunications ground is critical in protecting and equalizing telecommunications equipment. A proper grounding and bonding infrastructure is essential for the reliable operation of today's sensitive telecommunications equipment and systems.
- C. Telecommunications cabling and electrical power cabling must be effectively equalized.
- D. The grounding and bonding infrastructure is to originate at the service entrance (electrical power) ground and extend throughout the building to each telecommunications room.
- E. Building steel, neither water pipes, nor electrical service sub-panels are acceptable grounding points.
- F. Grounding and Bonding shall conform to NEC Article 250 and TIA/EIA-607-A using a minimum conductor size of 6 AWG.
 - 1. Install a contiguous Intra-building grounding and bonding system in compliance with NEC Article 250 and TIA/EIA-607-A.
 - 2. Use a minimum conductor size of 6 AWG
 - 3. Install a grounding busbar on each plywood backboard in each telecommunications room as directed.
 - 4. The grounding and bonding system shall originate at the service entrance (electrical power) ground and be a contiguous intra-building bus as shown in the example drawings.
 - 5. Bond all telecommunications equipment racks, backboards, conduits, and cable trays as specified in TIA/EIA-607 as shown in example drawings.

Small building grounding and bonding conceptual drawing:



Large building grounding and bonding conceptual drawing:





Conceptual (2) Rack Layout

Glossary:

BDF	Building Distribution Frame
BEF	Building Entrance Frame
BET	Building Entrance Termination
BICSI	Building Industry Consulting Service
International ER	Equipment Room
HC	Horizontal Cross Connect
IC	Intermediate Cross Connect IDF
Intermediate Distribution	
Frame MC	Main Cross Connect
MDF	Main Distribution Frame
RCDD	Registered Communications Distribution
Designer TO	Telecommunications Outlet
TR	Telecommunications Room
UTP	Unshielded Twisted Pair
FO	Fiber Optics

Last Updated: 03/24/25

Submitted by: Christopher M Olsen, RCDD (269086)



SECTION 27 41 00 AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, install, configure, test, and commission complete Audio-Video (AV) systems.
- B. Work includes:
 - 1. Audio systems.
 - 2. Video display systems.
 - 3. AV-over-IP distribution systems.
 - 4. Equipment racks and mounting hardware.
 - 5. Cabling and connectivity.
 - 6. Digital signal processing.
 - 7. Classroom presentation systems.
 - 8. Lecture capture interfaces.
 - 9. Integration with Audio-Visual Control Systems specified in Section 27 41 23.
 - 10. Integration with Audio-Video Conferencing Systems specified in Section 27 41

1.2 RELATED SECTIONS

Section 26 05 26 – Grounding and Bonding.
 Section 26 05 33 – Raceway and Boxes.
 Section 27 05 28 – Pathways for Communications Systems.
 Section 27 15 00 – Communications Horizontal Cabling.
 Section 27 41 16 – Integrated Audio-Video Systems and Equipment.
 Section 27 41 23 – Audio-Visual Control System.
 Section 27 41 43 – Audio-Video Conferencing.

1.3 DESIGN REQUIREMENTS

- A. Classroom systems shall be designed in accordance with the following room classifications:

- 1. BYOD Classroom:
 - a. Single display.
 - b. Wired and wireless presentation.
 - c. Lecture capture capable.
 - d. BYOD operation.
 - e. Touch-panel room control.

Part of System	Hardware	Quantity
Content Input	Dell UD22 10-in-1 Universal Docking Station (Black)	1
Content Input	AirMedia Series Kit w/AM-3100-WF Receiver and AM-TX-3100 Adaptor	1
Content Input	DM-NVX-384	1
Content Input	PW-2420RU (DM-NVX-384 power supply)	1

Microphone	None	0
Speaker	Shure ANIUSB-MATRIX USB Audio Network Interface	1
Speaker	Extron XPA U 1002 Series	1
Speaker	Extron FF 220 T (solid in Paris)	1
Camera	None	
Content Input	Epson PowerLite L530U 5200-Lumen WUXGA Education	1
Content Input	Epson V12H806001 Epson (ELPMBP06) SpeedConnect Suspended Ceiling Tile Kit	1
Content Input	Epson V12H81101 Epson 6" ELPMB03 Fixed Extension Column	1
Content Input	Projector Mount Business Machine Security LCD LOC II M W LCD LOC II	1
Content Input	Elite Screens Manual B Series 16:9 Pull-Down Projector Screen (110")	
Content Input	L Brackets for Manual/VMAX/Spectrum Screen	1
Content Input	Creston DM-NVX-360	1
Room Control	C4PN	1
Room Control	TS-1070-B-S	1
AVOIP	Netgear GSM420P-100NAS AV LineM4250-26G4F-POE+300W	1
AVOIP	C9200CX-12P-2X2G	
Equipment Rack	Middle Atlantic PTRK21 Portable Rolling Rack	1
Equipment Rack	Middle Atlantic UTR1 1 RU Mounting Rack shelf	5
Equipment Rack	Middle Atlantic PWR-9-RP Essex Rackmount Power 9-Outlet Horizontal Power Distribution	1
Cabling	Creston CBL-USB3G1-C-C-9	1
Cabling	Creston CBL-USB2-A-C-9	1
Cabling	3ft USB Type A to B 2.0	1
Cabling	6ft HDMI Cable	2
Cabling	3ft HDMI Cable	3
Cabling	6ft Cat6a cable (Blue)	3
Cabling	3ft Cat6a cable (Blue)	1
Cabling	3ft Cat6a cable (Black)	5
Cabling	400tf Cat 6A cable plenum-rated (Black) (unshielded)	1
Cabling	Leviton QuickPort CAT 6 Snap-In T568A/B Wiring Connector, White 61HOM-RW6	50
Cabling	100 CSP3200-22BULK 22-2 Shielded Twisted Pair Plenum, Bulk Cable	100
Cabling	6-Outlet Surge Protector	1

2. Standard Classroom:
- Dual-display system.
 - Single PTZ camera.
 - Ceiling microphone array.
 - Dedicated classroom computer.
 - BYOD operation.
 - Wireless presentation.

Part of System	Hardware	Quantity
Content Input	Slim Desktop-U5.16gb,512gb, NVIDIA A400, vPro, wireless	1
Content Input	27" Dell Pro 27 Plus Monitor – P2725H	1
Content Input	Dell UD22 10-in-1 Universal Docking Station (Black)	1
Content Input	AirMedia Series 3 Kit w/AM-3100-WF receiver and AM-TX3-100 Adaptor	1
Content Input	DM-NVX-384	1
Content Input	PW-2420RU (DM-NBX-384 power supply)	1
Content Input	DM-NVX-360	1
Content Input	KanexPro HDMI 4K USB 2.0 Gaming Capture Dongle with 3' HDMI cable	1
Content Input	C2G-4-port USB 3.1 Gen 1 Type-A Hub	1
Microphone	MXA 920	1
Microphone	Shure ANIUSB-MATRIX USB Audio Network Interface	1
Speakers	Extron FF 220T (sold in pairs)	1
Speakers	Extron XPA U 1002 Series	1
Camera	SRG-A40	
Camera	DM-NVX-360	
Camera	Lumens VC-WM14 3-in1 Multipurpose PTZ camera mount (black)	1
Content Input	Epson PowerLite L530U 5200-Lumen WUXGA education	1
Content Input	Epson V12H811001 Epson 6" ELPMB03 fixed extension column	1
Content Input	Chief Speed-Connect Replacement Ceiling Tile Kit CMS-445 (silver/white)	1
Content Input	Projector mount Business Machine Security LCD LOC II M W LCD LOC II	1
Content Input	Da-Lite 36445 Model C Manual Projection Screen (69"x110")	1
Content Input	Da-Lite White Floating Mounting Bracket	1
Content Input	Samsung QET 65" Class 4K UHD Commercial LED Display	1
Content Input	Medium Thinstall Dual Swing Arm Wall Display Mount-18 inch extension	1
Content Input	DM-NVX-360	2

Room Control	C4PN	1
Room Control	TS-1070-B-S	1
AVoIP	Netgear GSM420P-100NAS AV LineM4250-26G4F-POE+300W	1
AVoIP	C9200CX-12P-2X2G	1
Equipment Rack	Middle Atlantic PTRK21 Portable Rolling Rack	1
Equipment Rack	Middle Atlantic UTR1 1 RU Mounting Shelf	5
Equipment Rack	Middle Atlantic PWR-9-RP Essex Rackmount Power 9-Outlet Horizontal Power Distribution	1
For Podium	Spectrum Industries 95546B Engage Double 4419 Monitor Arm	1
Cabling	StarTech Display Port to HDMI Video Adapter Converter	1
Cabling	Crestron CBL-USB3-G1-C- C-9	1
Cabling	Crestron CBL-USB2-A-C-9	1
Cabling	3ft USB Type A to B 2.0	1
Cabling	10ft HDMI cable	2
Cabling	6ft HDMI Cable	2
Cabling	3ft HDMI Cable	7
Cabling	6ft Cat6a cable (blue)	3
Cabling	3ft Cat6a cable (blue)	1
Cabling	3ft Cat6a cable (black)	11
Cabling	400ft CatGA cable plenum-rated (black)	2
Cabling	Leviton QuickPort CAT 6 Snap-in T568A/B Wiring Connector, white 61HOM-RW6	50
Cabling	100 CSP3200-22Bulk 22-2 Shielded Twisted Pair Plenum, Bulk Cable	1
Cabling	6-Outlet Surge Protector	1

3. Advanced Classroom:
- Three-display system.
 - Dual PTZ camera configuration.
 - Ceiling and/or wireless microphone systems.
 - Dedicated Zoom Room operation.
 - Calendar integration.
 - Dedicated conferencing appliance or PC.
 - Dual control interfaces.

Part of System	Hardware	Quantity
Zoom Room PC/Appliance	Slim Desktop-u5, 16gb, 512gb, NVIDIA A400, vPro, wireless	1
Zoom Room PC/Appliance	Zoom Room License	1
Microphone	MXA 920	1
Microphone	Shure ANIUSB-MATRIX USB Audio	1

	Network Interface if mic count is greater than 1 or Shure P300 IntelliMix Audio Conferencing Processor if mic count is greater than 1	
Microphone	Chief Speed-Connect hardware kit	1
Speaker	F 220T (sold in pairs)	1
Speaker	Extron XPA U 1002 Series	1
Camera	SRG-A40	1
Camera	CAM570	1
Camera	DM-NVX-360	3
Camera	UVC-01 USB Video Capture	1
Camera	Lumens VC-WM14 3-in-1 Multipurpose PTZ Camera Mount (black)	2
Content Input	Slim Desktop-u5,16gb,512gb, NVIDIA A400, vPro, wireless	1
Content Input	27" Dell Pro 27 Plus Monitor-P2725H	1
Content Input	Dell UD22 10-in-1 Universal Docking Station (black)	1
Content Input	AirMedia Series 3 Kit with AM-3100-WF Receiver and AM-TX3-100 adaptor	1
Content Input	DM-NVX-384	1
Content Input	PW-2420RU (DM-NVX-384 power supply)	1
Content Input	DM-NVX-360	1
Content Input	Magewell USB Capture HDMI Gen 2	1
Content Input	Epson PowerLite L530U 5200-Lumen WUXGA education	1
Content Input	Epson V12H81101 Epson 6" ELPMBC03 Fixed Extension Column	1
Content Input	Epson V12H806001 (ELPMBP06) SpeedConnect Suspended Ceiling Tile Kit	1
Content Input	Projector Mount Business Machine Security LCD LOC II M W LCD LOC II	1
Content Input	Elite Screens Manual B Series 16:9 Pull-down Projector Screen (110")	1
Content Input	L brackets for Manual/VMAX/Spectrum Screens	1
Content Input	Samsung QET 65" Class 4K UHD Commercial LED Display	2
Content Input	Medium Thinstall Dual Swing Arm Wall Display Mount – 18-inch extension	2
Content Input	DM-NVX-360	5
Zoom Control	TS-1070-B-S	1
Room Control	C4PN	1
Room Control	TS-1070-B-S	1
AVoIP	Netgear GSM420P-100NAS AV LineM4250-26G4F-POE+300W	1

AVoIP	C9200CX-12P-2X2G	1
Equipment Rack	Middle Atlantic PTRK21 Portable Rolling Rack	1
Equipment Rack	Middle Atlantic UTR1 1 RU Mounting Rack shelf	5
Equipment Rack	Middle Atlantic PWR-9-RP Essex Rackmount Power 9-Outlet Horizontal Power Distribution	1
Podium	Spectrum Industries 95546B Engage Double 4419 Monitor Arm	1
Cabling	StarTech DisplayPort to HDMI Video Adapter Converter	3
Cabling	Creston CBL-USB3G1-C-C-9	1
Cabling	Creston CBL-USB2-A-C-9	1
Cabling	3ft USB Type A to B 2.0	1
Cabling	10ft HDMI cable	2
Cabling	6ft HDMI Cable	2
Cabling	3ft HDMI Cable	11
Cabling	6ft Cat6a cable (blue)	4
Cabling	3ft Cat6a cable (blue)	1
Cabling	3ft Cat6a cable (black)	14
Cabling	400ft CatGA cable plenum-rated (black)	3
Cabling	Leviton QuickPort CAT 6 Snap-In T568A/B Wiring Connector, White 61HOM-RW6	50
Cabling	100 CSP3200-22BULK 22-2 Shielded Twisted Pair Plenum, Bulk Cable	100
Cabling	6-Outlet Surge Protector	1

1.4 SUBMITTALS

- A. Product Data.
- B. Shop Drawings:
 - 1. System risers.
 - 2. Rack elevations.
 - 3. Device locations.
 - 4. Signal flow diagrams.
 - 5. Network topology.
- C. Programming documentation.
- D. Test reports.
- E. As-built drawings.

1.5 QUALITY ASSURANCE

- A. Installer shall possess minimum five years' experience installing higher education AV systems.
- B. Manufacturer certifications:
 - 1. Crestron Certified.
 - 2. Shure Certified.
 - 3. Extron Certified.
 - 4. Epson Certified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Control Systems:
 - 1. Crestron.
- B. AV-over-IP:
 - 1. Crestron DM-NVX.
- C. Audio:
 - 1. Shure.
 - 2. Extron.
- D. Displays:
 - 1. Epson.
 - 2. Samsung.
- E. Equipment Racks:
 - 1. Middle Atlantic.

2.2 AV NETWORK ARCHITECTURE

- A. Systems shall utilize AV-over-IP architecture based on Crestron DM-NVX technology.
- B. AV switching shall be performed through network-based transport rather than matrix switching.
- C. AV network switches shall be:
 - 1. Netgear M4250 Series.
 - 2. Cisco Catalyst 9200CX Series.

2.3 AUDIO SYSTEMS

- A. Ceiling Loudspeakers:

1. Extron FF 220T.
- B. Amplifiers:
 1. Extron XPA U 1002 Series.
- C. Audio Interfaces:
 1. Shure ANIUSB-MATRIX.
 2. Shure P300 IntelliMix Processor where multiple microphones are utilized.

2.4 EQUIPMENT RACKS

- A. Wall-mounted racks:
 1. Middle Atlantic DWR-12-22 pivoting rack.
- B. Rolling racks:
 1. Middle Atlantic PTRK21.
- C. Power Distribution:
 1. Middle Atlantic PWR-9-RP.

PART 3 - EXECUTION

3.1 PATHWAYS

- A. Provide minimum 1-1/4-inch blue ENT conduit from:
 1. Display locations.
 2. Podium locations.
 3. Equipment rack locations.
- B. Provide J-hook cable support system at maximum 5-foot spacing.

3.2 CABLING

- A. AV Horizontal Cabling:
 1. Category 6A UTP.
 2. CMP rated.
 3. Black jacket.
- B. Terminations:
 1. Ortronics HDJ6A-00 jacks.
 2. Permanent-link architecture.

3.3 TESTING

- A. Certify all Category 6A links to 10GBASE-T requirements.

- B. Testing shall be performed using Level III or better certification equipment.
- C. Submit certification reports.

3.4 DOCUMENTATION

- A. Provide:
 - 1. As-built drawings.
 - 2. Rack elevations.
 - 3. Programming backup.
 - 4. Network configuration files.
 - 5. Training documentation.

Type	Term	Definition	BYOD Classroom	Standard Classroom	Advanced Classroom
Room Capability	Web Conferencing	Online meetings or seminars using video, audio, and chat	Yes-Zoom Workplace App	Yes- Zoom Workplace App	Yes- Zoom Room
Room Capability	Wired Presentation	Show content or video via physical connections like cables	Yes	Yes	Yes
Room Capability	Wireless Presentation	Show content or video without cables.	Yes	Yes	Yes
Room Capability	Lecture Capture Recording	Recording and storing lectures for later viewing.	Yes	Yes	Yes
Room Capability	BYOD Mode	Personal devices can access room system (Display, speaker, camera, and microphone)	Yes	Yes	Yes
Room Capability	Calendar Integration	Automatically starts/ends Zoom meetings based on calendar information.	No	No	Yes
Hardware	Docking Station	Connects a laptop to multiple peripherals, like monitors, cameras, and network connections	Yes	Yes	Yes
Hardware	PTZ Camera	A camera that can pan, tilt, and zoom	Yes	Yes	Yes
Hardware	Microphone System	Captures sound for audio input	No	Yes-two	Yes- two
Hardware	Speaker/amplifier	Amplifies sound for audio output	Yes	Yes	Yes
Hardware	Display	Visual output from a device, like a monitor, TW, or projector	Yes- one	Yes – Two	Yes - Three
Hardware	Room Control/Touch Panel	Managed and controls various room devices through a touch interface.	Yes- Room control Only	Yes – Room Control Only	Yes – Room and Zoom Control
Hardware	Dedicated Classroom Computer	Podium computer for instructional content	No	Yes	Yes
Hardware	Zoom Room PC or Appliance	A dedicated device for running Zoom video conferencing software in a meeting room	No	No	Yes

END OF SECTION 27 41 00

SECTION 274116 INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish complete integrated classroom AV systems including all hardware, software, cabling, mounting, programming, and commissioning.

PART 2 - PRODUCTS

2.1 BYOD CLASSROOM SYSTEM

- A. Equipment Rack Components:
 - 1. Crestron RMC4 Control Processor.
 - 2. AV Network Switch.
 - 3. Extron XPA U 1002 Amplifier.
- B. Podium Components:
 - 1. Dell UD22 Docking Station.
 - 2. Crestron AirMedia Wireless Presentation.
 - 3. Crestron DM-NVX-384.
 - 4. Crestron TS-1070 Touch Panel.
- C. Display System:
 - 1. Epson PowerLite L530U projector.
 - 2. Projection screen minimum 110-inch diagonal.

2.2 STANDARD CLASSROOM SYSTEM

- A. Equipment Rack:
 - 1. RMC4 Processor.
 - 2. DM-NVX-360 Decoder.
 - 3. ANIUSB-MATRIX.
 - 4. AV Network Switch.
 - 5. Amplifier.
- B. Podium:
 - 1. Dell classroom PC.
 - 2. Dual monitors.
 - 3. Dell UD22 docking station.
 - 4. AirMedia wireless presentation.
 - 5. DM-NVX-384 encoder.
- C. Audio:

1. Shure MXA920 ceiling microphone.
2. ANIUSB-MATRIX DSP.
3. Extron FF220T speakers.

D. . Camera:

1. Sony SRG-A40 PTZ camera.

E. Displays:

1. Primary projector.
2. Secondary 65-inch minimum display.

2.3 ADVANCED CLASSROOM SYSTEM

A. Equipment Rack:

1. Crestron CP4N processor.
2. Zoom Room PC.
3. DM-NVX encoders and decoders.
4. AV network switch.
5. DSP processor.

B. Podium:

1. Dell classroom PC.
2. Dual monitors.
3. Docking station.
4. AirMedia.
5. Dual TS-1070 touch panels.

C. Audio:

1. MXA920 ceiling microphone.
2. ANIUSB-MATRIX or P300 DSP.
3. Extron amplifier and speakers.

D. Cameras:

1. Sony SRG-A40 PTZ camera.
2. AVer CAM570 PTZ camera.

E. Displays:

1. Primary projector system.
2. Two 65-inch minimum flat-panel displays.

2.4 INSTALLATION ACCESSORIES

A. Mounting brackets.

B. Ceiling tile support kits.

- C. Projector mounts.
- D. Monitor arms.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer recommendations.
- B. Coordinate mounting locations with structural backing requirements.
- C. Provide complete operational systems.

3.2 COMMISSIONING

- A. Verify operation of:
 - 1. Wired presentation.
 - 2. Wireless presentation.
 - 3. Audio reinforcement.
 - 4. Camera switching.
 - 5. Lecture capture.
 - 6. BYOD functionality.
 - 7. Display routing.

END OF SECTION 274116

SECTION 274123 AUDIO-VISUAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide centralized AV control systems for all classroom technology systems.

PART 2 - PRODUCTS

2.1 CONTROL PROCESSORS

- A. BYOD and Standard Classrooms:
 - 1. Crestron RMC4.
- B. Advanced Classrooms:
 - 1. Crestron CP4N.

2.2 TOUCH PANELS

- A. Crestron TS-1070-B-S.
- B. Capacitive touch display.
- C. PoE powered.

2.3 FUNCTIONAL REQUIREMENTS

- A. User interface shall provide:
 - 1. System Power.
 - 2. Source Selection.
 - 3. Display Control.
 - 4. Audio Volume.
 - 5. Mute Functions.
 - 6. Camera Presets.
 - 7. Wireless Presentation Control.
 - 8. Lecture Capture Functions.
- B. Advanced Classrooms:
 - 1. Zoom Room control integration.
 - 2. Meeting controls.
 - 3. Calendar integration.

2.4 PROGRAMMING

- A. Provide custom programming.
- B. Interface shall maintain common operation across all classroom types.

PART 3 - EXECUTION

3.1 CONTROL FUNCTIONS

- A. Single-button startup and shutdown.
- B. Automatic equipment sequencing.
- C. Display power management.
- D. Network monitoring.

3.2 TRAINING

- A. Provide administrator training.
- B. Provide instructor quick-start documentation.

END OF SECTION 274123

SECTION 274143 AUDIO-VIDEO CONFERENCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and configure conferencing systems supporting:
 - 1. Zoom
 - 2. Zoom Rooms.
 - 3. BYOD conferencing.
 - 4. Lecture capture integration.

PART 2 - PRODUCTS

2.1 CONFERENCING PLATFORMS

- A. Standard Classrooms:
 - 1. Zoom Workplace.
- B. Advanced Classrooms:
 - 1. Zoom Rooms.
 - 2. Zoom Room License.
 - 3. Dedicated Zoom Room PC.

2.2 CAMERAS

- A. Standard Classroom:
 - 1. Sony SRG-A40 PTZ Camera.
- B. Advanced Classroom:
 - 1. Sony SRG-A40 PTZ Camera.
 - 2. Aver CAM570 PTZ Camera.

2.3 MICROPHONES

- A. Shure MXA920 Ceiling Array.
- B. Shure ANIUSB-MATRIX.
- C. Shure P300 IntelliMix DSP where required.

2.4 USB INTERFACES

- A. Magewell USB Capture HDMI Gen 2.

- B. UVC-01 USB Video Capture.

PART 3 - EXECUTION

3.1 SYSTEM PERFORMANCE

- A. Conferencing systems shall support:
 - 1. Full-duplex audio.
 - 2. Echo cancellation.
 - 3. Automatic gain control.
 - 4. Acoustic echo suppression.
 - 5. Presenter tracking.
 - 6. BYOD USB connectivity.

3.2 ADVANCED CLASSROOM FUNCTIONS

- A. One-touch meeting join.
- B. Calendar synchronization.
- C. Multiple camera presets.
- D. Simultaneous local and remote content sharing.
- E. Dedicated Zoom Room operation independent of instructor laptop.

3.3 ACCEPTANCE TESTING

- A. Demonstrate:
 - 1. Local presentation.
 - 2. Wireless presentation.
 - 3. Remote conferencing.
 - 4. Camera presets.
 - 5. Microphone coverage.
 - 6. Audio intelligibility.
 - 7. Zoom Room functionality.

END OF SECTION 274143

SECTION 281300 – ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The existing access control system at Idaho State University is a network-based SQL server framework manufactured by CBORD. ISU has an existing CBORD access control system and server installed, and all work associated with this project shall be installed using CBORD components by installation professionals with 5 years' experience installing similar systems.
- B. Access Control Contractor:
 - 1. The access control contractor shall submit documentation showing that they are a certified access control vendor providing access control system products for at least three years. Technicians must be certified and have a fully staffed office within 100 miles of ISU. Names, addresses and telephone numbers of all certified technicians along with documentation showing their certification must be provided. The access control contractor's corporate headquarters, located within 100 miles of ISU, must guarantee a response time of 4 hours, 24 hours per day and 365 days per year, for any major malfunction. Response times for minor station malfunctions, additions, or system changes will be 24 hours. A reasonable supply of backup parts must be maintained at vendor's corporate headquarters to facilitate rapid response to major system malfunctions.
 - 2. The installer shall be factory trained at time of bid.
 - 3. The installer shall provide 5,000 Schlage MIFARE DESFire EV1 Cards
 - a. 2K byte/16k bit, magstripe, ISO Glossy White, p/n: 8520M1. CardTrax for customer- held key.
 - 1) FORMAT: VERIFY WITH ISU PUBLIC SAFETY PRIOR TO ORDER.
 - 2) FACILITY CODE: VERIFY WITH ISU PUBLIC SAFETY PRIOR TO ORDER.
 - 3) START #: VERIFY WITH ISU PUBLIC SAFETY PRIOR TO ORDER.
 - b. Coordinate and Provide ISU new card double sided artwork to CBORD.
 - c. CBORD factory certified systems implementation work performed remotely and during one trip to campus; systems implementation scope includes: setup of two new media types (DESFire EV1 and CSN), new card number lookup table, update to five existing CardLink (printer) setups, assistance with walking through updating existing readers/locks using custom programming key)
 - d. Contact Ryan Wagner at CBORD, 950 Danby Road Suite 100 Ithaca NY 14850 for cost of CBORD systems implementation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The access control equipment shall consist of the following equipment or Design Professional approved equivalent equipment:
1. Access Control System:
 - a. Existing CBORD Server
 2. CBORD Dual Interface Module:
 - a. CBORD ACS6727075
 3. Networked Controller:
 - a. Mercury MP1502
 4. Credential reader:
 - a. HID Multiclass SE MBT11 or MBT15.
 - b. Altronix T2M7LXK1DSY with AL1024ULXB2, ACMS8CB, PDS8CB, RBS1
 5. Door contacts recessed indoor:
 - a. GRI 180MC-12-B series
 - b. Or equal
 6. Door contacts surface mounted:
 - a. GE Sentrol 2500 series
 - b. Or equal
 7. Door Contacts – Overhead doors:
 - a. GE Sentrol 2200
 - b. Seco-Larm – SM-4201-1Q
 - c. Or equal
 8. Door Contacts – Overhead Doors:
 - a. GE Sentrol 2200
 - b. Seco-Larm – SM-4201-1Q
 - c. Or equal
 9. Credential Reader Cable
 - a. Windy City Wire 002320- white
 10. Access Control Wire
 - a. Windy City Wire 4461030-Green or equal.
 11. Wireless integrated lockset
 - a. Schlage AD400-CY 50 MTK- RHO-626-J-RH-8B-13-247-10-0255-1-3/4-LFIC PREP
 12. Wireless Network integrator for lockset
 - a. Schlage PIM 400-485

2.2 VENDOR

- A. The vendor for the system shall be located within 100 miles of ISU and shall be able to respond to problems within two hours of being called.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The access control system shall be installed in accordance with the manufacturer's recommendations.

- B. All wiring for the access control system shall be in conduit in walls and gypsum ceilings and free air cable from j-hooks above accessible ceilings.
- C. The access control system shall be tested by ISU and the installation contractor for proper operation.

END OF SECTION 281300

SECTION 28 23 00.1 VIDEO SURVEILLANCE MULTI SENSOR

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, install, configure, test, and commission complete Video Surveillance system.
- B. Work includes:
 - 1. Video Cameras.

1.2 RELATED SECTIONS

- Section 28 23 00.1 – Video Surveillance Multi Sensor.
- Section 28 23 00.2 – Video Surveillance Panoramic.
- Section 28 23 00.3 – Video Surveillance Dome.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. This no charge service shall be available to dealers and installers.

2.02 OUTDOOR MULTI-SENSOR SERIES CAMERA

- A. The outdoor multi-sensor camera shall incorporate four camera/lens modules to provide a 360° panoramic view. The camera shall be available for indoor/outdoor surface mounting. The high-resolution day/night camera shall have true WDR and IR capability and include four integral motorized lenses. Day/night operation shall be achieved using a built-in IR-cut filter. IR distance shall be 131 ft (40 m). A clear polycarbonate lower dome shall be included. Starlight low-light imaging shall be provided by these cameras.
- B. All four sensors shall be motorized so users can quickly and easily configure them remotely. The cameras shall include presets for 180°, 270° and 360° of coverage; customized views shall also be configurable through each sensor's PTZ controls.
- C. The camera shall have smart encoding, which monitors the amount of motion in a scene, resulting in overall savings in storage and bandwidth without sacrificing video quality.
- D. The camera shall be powered by PoE++, 24 VAC or 24 VDC.

- E. The camera shall have triple streaming video and support H.264/H.265 compression. The camera modules shall be available in 5 MP or 8 MP resolution, offering a 20 MP or 32 MP resolution mode.
- F. Camera features shall include electronic iris, AGC, true WDR, white balance, backlight compensation, tampering, flip, mirror, privacy masks and motion detection.
- G. The camera shall provide Intelligent Video Analysis, tampering/defocus, intelligent motion detection, intrusion detection, line cross, loitering, object left/removed, tailgating and crowding. It shall also provide AI-based object classification analytics for vehicles, people and animals.
- H. The camera shall meet the FCC requirements for a Class A device. It shall include support for the industry-standard ONVIF interface. It shall be IP66-rated to withstand rain, dust and vandalism and IK10 rated for impact resistance. The camera shall be NDAA compliant.
- I. The camera shall provide a slot for an SD card for local storage.
- J. There shall be mounting accessories to allow wall mounting, pendant mounting, and an adapter to allow corner and pole mounting.
- K. The fixed-position camera shall meet or exceed the following design and performance specifications.

2.03 DAY/NIGHT IP CAMERA DOME SPECIFICATIONS

- A. Imaging Device: 5 MP: 4x 1/2.8-inch progressive scan CMOS
8MP: 4x 1/1.8-inch progressive scan CMOS
- B. Max. Resolution: 4x 2592 x 1944 (5 MP)
4x 3840 x 2160 (8 MP)
- C. Shutter Speed: 1/7 - 1/20,000 sec
- D. Automatic Gain Control: On/Off selectable
- E. Sensitivity: 20 MP: Color: 0.03 lux; B&W: 0.01 (IR OFF), 0 lux (IR On) @30 IRE
32 MP: Color: 0.02 lux; B&W: 0.01 (IR OFF), 0 lux (IR On) @30 IRE
- F. Wide Dynamic Range: True WDR, 120dB
- G. Focal Length: 4x 3.1-10 mm
- H. Field of View (tele-wide): 20 MP: Horiz: 32°-96°; Vert: 24°-69°; Depth: 40°-124°
32 MP: Horiz: 46°-98°; Vert: 26°-54°; Depth: 54°-113°
- I. IR Distance: 131 ft (40 m) @ IEEE802.3bt

2.04 ELECTRICAL SPECIFICATIONS

- A. Input Voltage: PoE++ (IEEE802.3bt Class 5), 24 VAC, 24 VDC
- B. Current (IR on): 1.7 A;
- C. Power Consumption (IR on): 40 W
- D. Connectors: Pigtail: Power: terminal block
PoE/Network: RJ-45
Alarm In/Out: terminal block
Audio: phone jack

Slot for SD card

- E. Radio Frequency
Emission Rating: FCC Class A; CE

2.05 ENVIRONMENTAL SPECIFICATIONS

- A. Operating Temperature: -40° to 131°F (-40° to 55°C)
B. Humidity: 10% to 90% relative, non-condensing

2.06 PHYSICAL SPECIFICATIONS

- A. Construction: Die-cast aluminum housing
Dome: clear polycarbonate
B. Dimensions: Height: 5.6 in. (142.3 mm),
Diameter: 9.7 in. (247.5 mm)
C. Weight: Approximately 5.2 lb (2.36 kg)

2.07 MECHANICAL SPECIFICATIONS

- A. Camera Mount: Surface mount; includes mounting cap. Mounting options available.
B. Remote Adjustment: Pan 360°; Tilt: 90° (default value 83°)

2.08 NETWORK VIDEO SPECIFICATIONS

- A. Communication Platform: Open platform; compatible with Valerus and ViconNet Video Management Systems
B. Compression: H.264/H.265
C. LAN Interface: 10/100
D. Video Channels: Triple streaming
E. Max Resolution and Frame Rate: 20 MP: 4x 2592x1944; 32 MP: 3840 x 2160
Max 30 fps at 20 MP and 32 MP
F. Web Browser: Internet Explorer, Firefox, Google Chrome
G. Users: Up to 10 clients
H. Image Settings: Day/night mode; flip and mirror; configurable brightness, contrast, hue, sharpness, saturation; white balance, gain control; DNR; true WDR (120dB); privacy masks (5); motion detection; BLC; Exposure; Audio
I. Intelligent Video Analytics: Tampering, Intelligent Motion Detection, Intrusion Detection; Line Cross, Loitering, Object Left/Removed, Tailgating, Crowding.
It shall also provide AI-based object classification analytics for vehicles, people and animals. This shall enhance working with Museum Search in Valerus VMS.
J. Supported Protocols: IPv4/IPv6, TCP/IP, HTTP, HTTPS, RTSP, RTP, RTCP, SMTP, FTP, UDP, uPnP, QoS, ICMP, SNMP v2c/v3, SSL, DNS, NTP, LDAP (client), Zeroconfig, DynDNS, ONVIF S/G/M/T

2.09 CERTIFICATIONS

- A. CE
B. FCC, Class A

- C. IP66
- D. IK10
- E. UL
- F. ONVIF S/G/M/T
- G. NDAA/GSA/TAA compliant

2.10 WARRANTY

- A. 5 years, parts and labor

2.11 APPROVED MANUFACTURERS

- A. The outdoor color IP multi-sensor camera shall be Vicon Industries Model V2020-WIR-360 (20 MP) and V2032-WIR-360 (32 MP).

END OF SECTION

Vicon is a registered trademark of Vicon Industries Inc. in the United States and other countries.

SECTION 282300.2 VIDEO SURVEILLANCE PANORAMIC

PART 2 - PRODUCTS

2.01 GENERAL

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. This no charge service shall be available to dealers and installers.

2.02 OUTDOOR IP PANORAMIC DOME CAMERA

- A. The outdoor panoramic dome camera shall incorporate a fixed camera/lens combination. The camera dome shall be available for indoor/outdoor surface mounting. The high-resolution day/night camera be available in a 12 MP resolution model and shall have True WDR and Smart IR capability and shall include an integral fixed fisheye lens. This lens shall provide an extremely wide angle of view for a panoramic image, capturing a 180° panoramic view and a 360° surround view at full HD resolution. Day/night operation shall be achieved using a built-in IR-cut filter. IR distance shall be 49 ft (15 m) with 1 IR LEDs.
- B. The camera shall provide a high-resolution hemispherical view and shall provide crisp distortion free images and support on-board and web de-warping.
- C. A variety of mounting options shall be available.
- D. The panoramic dome camera shall be powered by PoE+ or 24 VAC. A dual heater system shall be provided that maintains proper temperature in the camera housing and prevents fogging of the window.
- E. The panoramic dome camera shall have triple streaming video and support H.264/H.265 and M-JPEG compression. The camera shall also have smart encoding to further improve video encoding and improve storage capacity.
- F. Camera features shall include electronic iris, AGC, WDR, white balance, defog, flip, privacy masking, dynamic ROI and motion detection. It shall have Intelligent Video Analytics of tampering/defocus, intelligent motion detection, intrusion detection, line cross, loitering, object left/removed, tailgating and crowding; it shall also provide Museum Search. It shall also provide AI-based object classification analytics for vehicles, people and animals.
- G. The panoramic dome camera shall meet the FCC requirements for a Class A device. It shall include support for the industry-standard ONVIF S/T/G/M interface. It shall be IP67-rated to withstand rain, dust and vandalism and IK10 rated for impact resistance. The camera shall meet the latest regulations required to be NDAA, GSA schedule and TAA approved.
- H. The panoramic dome camera shall provide a slot for an SD card for local storage.

- I. The panoramic dome camera shall meet or exceed the following design and performance specifications.

2.03 DAY/NIGHT IP PANORAMIC DOME CAMERA SPECIFICATIONS

- A. Imaging Device: 1/2.3-inch
- B. Max. Resolution: 12 MP
- C. Shutter Speed: 1/2 - 1/10,000 sec
- D. Automatic Gain Control: On/Off selectable
- E. Sensitivity (@30 IRE): Color: 0.07 lux; B&W: 0.1 (IR Off), 0 lux (IR On)
- F. Digital Zoom: Dynamic ROI
- G. Lens Adjustment: Fixed Fisheye
- H. Focal Length: 1.6 mm
- I. Field of View: 195° (at full resolution); 360° surround view
- J. IR Distance: Smart IR; 49 ft (15 m) with 1 IR LED
- K. Dual Heater System: For low temperature operation: heater turns on at -40° F (-40° C) and off at 59° F (15° C).
For defog operation: heater turns on at -40° F and off at 140° F (60° C).

2.04 ELECTRICAL SPECIFICATIONS

- A. Input Voltage: PoE+ or 24 VAC
- B. Current: PoE: 0.52 A; 24 VAC: 1.1 A
- C. Power Consumption: IR/Heaters On: 25 W; IR off: 12.2 W
- D. Connectors: Optional backbox available for cabling
PoE Power: RJ-45; 24 VAC: terminal block
Video/Data: RJ-45
Audio In/Out: screw terminal; built-in mic; audio level alarm alert
Slot for SD card (128 G max customer supplied card)
Reset button
Default button
- E. Radio Frequency Emission Rating: FCC Class A; CE

2.05 ENVIRONMENTAL SPECIFICATIONS

- A. Operating Temperature: -40° to 122°F (-40° to 50°C)
- B. Humidity: Up to 90% relative, non-condensing

2.06 PHYSICAL SPECIFICATIONS

- A. Construction: Aluminum alloy housing; PC+ABS front case
- B. Dimensions: Height: 2.2 in. (57 mm),
Diameter: 5 in. (150 mm)
- C. Weight: 2 lb (0.9 kg)

2.07 MECHANICAL SPECIFICATIONS

- A. Camera Mount: Surface mount

2.08 NETWORK VIDEO SPECIFICATIONS

- A. Communication Platform: Open platform; compatible with Valerus Video Management System
- B. Compression: Smart Encoding; H.264/H.265; M-JPEG
- C. LAN Interface: 10 Base-T/100 Base-TX, Unicast/Multicast
- D. Video Channels Triple streaming
- E. Resolution and Frame Rate: 2976x2976, 2592x2592, 2048x2048, 1952x1952, 1536x1536, 1280x1280, 960x960, 640x640.
Max 30 fps
- F. Web Browser: Internet Explorer, Safari, Firefox, Chrome, Microsoft Edge
- G. Users: Live viewing for up to 10 clients
- H. Image Settings: Digital image effects defog, flip; configurable brightness, contrast, saturation, hue, sharpness; BLC; HLC; gamma correction; 3 DNR; motion detection; white balance, AGC; Electronic Shutter, automatic or manual; digital zoom; motion detection; privacy masks; dynamic ROI
- I. Intelligent Video Analytics: Tampering/Defocus, Intelligent Motion Detection Intrusion Detection; Line Cross, Loitering, Object Left/Removed, Tailgating, Crowding. It shall also provide AI-based object classification analytics for vehicles, people and animals. This shall enhance working with Museum Search in Valerus VMS.
- J. Supported Protocols: IPv4/IPv6, TCP, HTTP, HTTPS, RTSP, RTCP, RTP, RTMP, SMTP, SNMP v1/2c/3, UPnP, TLS/TTLS, FTP, HLS, ICMP, IGMP, LDAP, NTP, DHCP, DNS, DDNS, UDP, QoS, ARP, PPPoE, Bonjour, ONVIF S/G/M/T

2.09 CERTIFICATIONS

- A. CE
- B. UL
- C. FCC, Class A
- D. IP67
- E. IK10
- F. ONVIF S/T/G/M
- G. RoHS
- H. NDAA/GSA/TAA compliant

2.10 WARRANTY

- A. 5 years, parts and labor

2.11 APPROVED MANUFACTURERS

- A. The outdoor IP panoramic dome camera shall be Vicon Industries V2360W-12-1.

END OF SECTION

Vicon is a registered trademark of Vicon Industries Inc. in the United States and other countries.

SECTION 28 23 00.3 VIDEO SURVEILLANCE DOME

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, install, configure, test, and commission complete Video Surveillance system.
- B. Work includes:
 - 1. Video Cameras.

1.2 RELATED SECTIONS

- Section 28 23 00.1 – Video Surveillance Multi Sensor.
- Section 28 23 00.2 – Video Surveillance Panoramic.
- Section 28 23 00.3 – Video Surveillance Dome.

PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.01 GENERAL

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. This no charge service shall be available to dealers and installers.

2.02 OUTDOOR IP DOME CAMERA

- A. The outdoor fixed dome camera shall incorporate a fixed camera/lens combination. The camera dome shall be available for indoor/outdoor surface mounting. The high-resolution day/night camera be available in a 5 MP resolution model and shall have true WDR and Smart IR/Adaptive IR capability and shall include an integral fixed 2.8 mm lens. Day/night operation shall be achieved using a built-in IR-cut filter. IR distance shall be 49 ft (15 m) with 8 IR LEDs. The camera shall have bi-directional audio, built-in mic and line out.
- B. The camera position shall have a three-direction adjustment, allowing for adjustment of pan, tilt and lens rotation (roll), for any angle of view required. A variety of mounting options shall be available.
- C. The camera shall provide Intelligent Video Analytics, tampering, intelligent motion detection, intrusion detection, line counting/cross, loitering, object left/removed, wrong direction and area counting, and Museum Search. The camera shall provide AI-based object classification analytics for vehicles, people and animals.

- D. The dome camera shall be powered by PoE.
- E. The dome camera shall have triple streaming video and support H.264/H.265 and M-JPEG compression. The camera shall also have smart encoding to further improve video encoding and improve storage capacity.
- F. Camera features shall include electronic iris, AGC, TWDR, white balance, defog, flip, mirror, privacy masking, ROI, motion detection and museum search.
- G. The dome camera shall meet the FCC requirements for a Class A device. It shall include support for the industry-standard ONVIF S/T/G/Q interface. It shall be IP67-rated to withstand rain, dust and vandalism and IK10 rated for impact resistance. The camera shall meet the latest regulations required to be NDAA, GSA schedule and TAA approved.
- H. The dome camera shall provide a slot for an SD card for local storage.
- I. The dome camera shall meet or exceed the following design and performance specifications.

2.03 DAY/NIGHT IP DOME CAMERA SPECIFICATIONS

- A. Imaging Device: 1/2.8-inch progressive scan
- B. Max. Resolution: 5 MP model
- C. Shutter Speed: 1/2 - 1/10,000 sec
- D. Automatic Gain Control: On/Off selectable
- E. Sensitivity (@ 30IRE): Color: 0.03 lux; B&W: 0.01 lux/0 lux (IR Off/On)
- F. Tilt and Horizontal: Three-direction adjustment, allowing for adjustment of pan, tilt and lens rotation (roll)
- G. Digital Zoom: Yes (ROI)
- H. Lens Adjustment: Fixed
- I. Focal Length: 2.8 mm
- J. Horizontal Field of View: 104°;
- K. Vertical Field of View: 5 MP: 78°
- L. Depth Field of View: 134°
- M. IR Distance: Smart IR/Adaptive IR; 49 ft (15 m) with 8 IR LEDs

2.04 ELECTRICAL SPECIFICATIONS

- A. Input Voltage: PoE
- B. Current: PoE: 0.28 A
- C. Power Consumption: IR On: PoE: 13.5 W; IR Off: 8.5 W
- D. Connectors: Pigtail cable provided; optional backbox required for cabling
PoE Power: RJ-45
Video/Data: RJ-45
Audio: Built-in mic; line out screw terminal; audio level alarm alert
Slot for SD card (128 G max customer supplied card)
Reset button
Default button
- E. Radio Frequency Emission Rating: FCC Class A; CE

2.05 ENVIRONMENTAL SPECIFICATIONS

- A. Operating Temperature: -22° to 131°F (-30° to 55°C)
- B. Humidity: Up to 90% relative, non-condensing

2.06 PHYSICAL SPECIFICATIONS

- A. Construction: Aluminum dome housing; polycarbonate clear dome
- B. Dimensions: Height: 2.2 in. (57 mm),
Diameter: 4.3 in. (110 mm)
- C. Weight: 1.65 lb (0.75 kg)

2.07 MECHANICAL SPECIFICATIONS

- A. Camera Mount: Surface mount
- B. Adjustments: 3-axis camera adjustment: pan 0°-180°; tilt 0°-80°;
roll ±355°

2.08 NETWORK VIDEO SPECIFICATIONS

- A. Communication Platform: Open platform; compatible with Valerus Video Management System
- B. Compression: Smart Encoding; H.264/H.265; M-JPEG
- C. LAN Interface: 10 Base-T/100 Base-TX, Unicast/Multicast
- D. Video Channels: Triple streaming
- E. Resolution and Frame Rate: 5 MP: 2592x1944/1520, 2560x1440, 2048x1536, 2304x1296, 1920x1080, 1600x1200, 1440x1080, 1600x900, 1280x960/720, 800x600, 640x480, 640x360, 320x240, 320x180
Max 30 fps
- F. Web Browser: Safari, Firefox, Chrome, Microsoft Edge
- G. Users: Live viewing for up to 10 clients
- H. Image Settings: Digital image effects defog, flip and mirror; configurable brightness, contrast, saturation, hue, sharpness; BLC; HLC; gamma correction; 3 DNR; motion detection; white balance, AGC; Electronic Shutter, automatic or manual; digital zoom; motion detection; privacy masks; motorized zoom and focus (lens); dynamic ROI
- I. Intelligent Video Analytics: Tampering/Defocus, Intelligent Motion Detection
Intrusion Detection; Line Counter/Cross, Loitering, Object Left/Removed, Wrong Direction, Area Counting.
The camera shall provide AI-based object classification analytics for vehicles, people and animals. This shall enhance working with Museum Search in Valerus VMS.
- J. Supported Protocols: IPv4/IPv6, TCP, HTTP, HTTPS, RTSP, RTCP, RTP, RTMP, SMTP, SNMP v1/2c/3, UPnP, TLS/TTLS, FTP, HLS, ICMP, IGMP, LDAP, NTP, DHCP, DNS, DDNS, UDP, QoS, ARP, PPPoE, Bonjour, ONVIF S/G/Q/T

2.09 CERTIFICATIONS

- A. CE
- B. UL
- C. FCC, Class A

- D. IP67
- E. IK10
- F. ONVIF S/T/G/Q
- G. RoHS
- H. NDAA/GSA/TAA compliant

2.10 WARRANTY

- A. 5 years, parts and labor

2.11 APPROVED MANUFACTURERS

- A. The outdoor IP micro dome camera shall be Vicon Industries V2005D-W28IRM.

END OF SECTION

Vicon is a registered trademark of Vicon Industries Inc. in the United States and other countries.

SECTION 283100 - FIRE ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fire alarm systems.
- B. Related Sections include the following:
- C. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 SYSTEM DESCRIPTION

- A. Addressable system; multiplexed signal transmission dedicated to fire alarm service with horn/strobes. This system shall be capable of handling the entire fire system requirements of the building including, but not limited to fire sprinkler monitoring, magnetic door hold open equipment, HVAC equipment, Elevator Recall and horn/strobes throughout the entire building.

1.5 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Premises protection includes Fully Sprinkled Type Occupancy.
- C. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.

2. Heat detectors.
 3. Flame detectors.
 4. Smoke detectors.
 5. Verified automatic alarm operation of smoke detectors.
 6. Automatic sprinkler system water flow.
 7. Fire extinguishing system operation.
 8. Fire standpipe system.
- D. 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. Unlock electric door locks in designated egress paths.
 6. Release fire and smoke doors held open by magnetic door holders.
 7. Activate voice/alarm communication system.
 8. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 9. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
 10. Record events in the system memory with ability to be printed.
- E. Supervisory signal initiation shall be by one or more of the following devices or actions:
1. Operation of a fire-protection system valve tamper.
 2. Operation of any duct detectors or induct detectors.
- F. 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.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- G. System Trouble and Supervisory Signal Actions: Annunciate at the FACP and remote annunciators. Record the event on system memory with ability to be printed.

1.6 SUBMITTALS

- A. Prior to the start of work, the contractor shall provide a complete and comprehensive

submittal for review by the engineer. Once the engineer of record has reviewed and approved the submittal, the contractor shall provide a complete submittal to the Authority Having Jurisdiction for their review and approval. The contractor is responsible for obtaining and paying for the fire alarm permits that may be required. The submittals shall be prepared by a NICETIV certified, factory trained personnel. This person shall provide to the engineer of record the proof of NICET certification and proof of factory training if requested. Factory training means that this person has received training at the factory. These are to describe the proposed system and its equipment. Failure to provide a complete submittal shall be grounds for summary rejection of any incomplete submittal documentation. Contractors who provide re-submittal's, due to prior rejection shall be subject to a re-review fee, should the Engineer elect to do so. The complete submittal shall include, but not be limited to, all of the following material:

- B. Power Calculations
- C. Battery capacity calculations shall be a minimum of 125% of the calculated requirement.
 - 1. Supervisory power requirements for all equipment.
 - 2. Alarm power requirements for all equipment.
 - 3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition plus 25% spare capacity.
 - 4. Voltage-drop calculations for wiring runs demonstrating worst case condition.
- D. Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
- E. Complete drawings covering the following shall be submitted by the contractor for the proposed system. Floor plans in a CAD compatible format showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used. Floor plans will be prepared at 1/8" scale.
- F. A complete proposed system database including a description of all logic strings, control by event programming and point identification labels on a flash drive and in a formatted printed form, as required for offsite editing, shall be submitted for evaluation by the owner.
- G. The program shall include all required interactive control functions between the local network systems and the methods for implementing these actions.
- H. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off-hour warranty issues.
- I. If the fire alarm system and its equipment are supplied by a manufacturer's distributor, as part of the submittal documentation, the manufacturer shall provide, on its corporate letterhead, a "letter of support". Said "letter of support" shall state that, when in the opinion of the Engineer, the distributor's efforts require back-up and/or assistance, the manufacturer shall provide, at no cost to the Owner, all required technical support

during the installation phase and for a one (1) year guarantee period starting on the date of final acceptance by the owner and the authority having jurisdiction. If said "letter of support" is not submitted, the manufacturer's equipment will be deemed unacceptable and shall be grounds for summary rejection.

- J. Provide a fire alarm system function matrix. Matrix shall illustrate alarm output events in association with initiating devices input events. Matrix shall represent a summary of the installed system alarm, supervisory and trouble functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at the time of bid. Failure to provide this requirement shall be cause for summary rejection of submittal documents where additional departures are discovered. (See NFPA-72 for minimum matrix requirements)
- K. For each system control panel and/or transponder panel, provide panel ampere loading during both normal and alarm modes, with time calculations to substantiate compliance with battery back-up power requirements (battery Ampere-Hour capacity), described elsewhere in these specifications.
- L. For each system control panel and/or transponder panel, provide written schedule of active and spare addresses provided on each addressable circuit to substantiate compliance with circuit usage/spare requirements, described elsewhere in these specifications.
- M. For each system control panel and system transponder notification appliance circuit provide a written schedule of spare capability in amperes available for future possible use.
- N. Provide manufacture's printed product data, catalog pages and descriptions of any special installation requirements and/or procedures. Drawings depicting any special physical installation requirements shall show physical plans, elevations, all dimensions, conduit entry, minimum access clearances and any other details required.
- O. Provide shop drawings as follows:
- P. Drawing or catalog page showing actual dimensions of the main FCS.
 - 1. Drawing(s) or catalog page(s) showing actual dimensions of any additional system control panels, and/or battery cabinets.
 - 2. Drawing or catalog page showing actual dimensions of the remote annunciator(s).
 - 3. Single line riser diagram showing, all equipment, all connections and number and size of all conductors and conduits.
 - 4. Provide samples of various items when so requested by the architect/engineer.
- Q. The fire protection contractor shall provide copies of certification for service technician's formal training by the system manufacture. As a minimum, certification documents shall indicate training dates, systems qualified, name of individual certified and current status.

- R. Product Data: For each type of product indicated within 90 days of notice to proceed.
- S. Within 30 days of notice to proceed, the contractor shall submit a programming printout and digital copy of the program to the Engineer for review.
- T. Qualification Data: For Installer: NICET Level III certification within 30 days of notice to proceed.
- U. Field quality-control test reports: provide test reports 10 days prior to final test requirements.
- V. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- W. Documentation:
 - 1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
 - 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
 - b. Electronic media may be provided to Architect.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III. Designer qualifications NICET IV. Quality control company shall have on staff a ICC certified electrical inspector for rough in inspections and final inspections by the Fire alarm contractor.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. 30 days after award of bid, the contractor shall conduct a meeting with the owner; owners representative, the Engineer and the architect to discuss compliance of the specifications and drawings.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are

packaged with protective covering for storage and identified with labels describing contents.

1. Initiating Appliances: Quantity equal to 11 percent of amount of each type installed, but not less than 1 unit of each type.
2. Detector Bases: Quantity equal to 1 percent of amount of each type installed, but not less than 1 unit of each type.
3. Keys and Tools: One extra set for access to locked and tamper proofed components.
4. Audible and Visual Notification Appliances: One of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by only the following:
 1. FACP and Equipment:
 - a. Edwards
 - b. No equals excepted.
 2. Audible and Visual Signals:
 - a. System Sensor

2.2 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.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 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, three line(s) of 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.
 - a. System Layout: Each signaling line circuit shall be loaded no more than 80% capacity.
 2. Notification-Appliance Circuits: NFPA 72, Class A.
 3. Notification-Appliance Circuits: NFPA 72, Class B.
 4. Actuation of alarm notification appliances, annunciation, smoke control, shall occur within 10 seconds after the activation of an initiating device.
 5. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
- D. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
 2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
 3. Sound general alarm if the alarm is verified.
 4. Cancel FACP indication and system reset if the alarm is not verified.
- E. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.
- F. 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.
- G. 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.
- H. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program

repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.

- J. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.
 - 1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- K. 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 CIRCUIT."
- L. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
 - 1. Batteries: Vented, wet-cell pocket, plate nickel cadmium.
 - 2. Battery and Charger Capacity: Comply with NFPA 72.
- M. Surge Protection:
 - 1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 26 Section "Transient Voltage Suppression" for auxiliary panel suppressors.
 - 2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- N. 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.

2.3 FIRE ALARM DOCUMENT CABINET

- A. General Description:
 - 1. Minimum 18 gauge steel construction
 - 2. Textured, baked on red enamel finish
 - 3. Business card holder
 - 4. Key ring hooks
 - 5. Legend sheet for passwords and system information
 - 6. Cover shall have white lettering that reads "SYSTEM RECORD DOCUMENTS"

2.4 Addressable initiation 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.
- B. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
 - 1. Single-action mechanism requiring single actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. MANUAL FIRE ALARM BOX'S SHALL BE MF-7AF.

2.5 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. Multipurpose type, containing the following:
 - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - b. Heat sensor, combination rate-of-rise and fixed temperature.
 - 4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
 - 7. Where noted on drawings provide a welded wire screen protective cover.
 - 8. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
 - a. The number of FACP settable levels varies among manufacturers and between detector types. Indicate the specific number of levels on Drawings or in the "Remarks" column of a detector schedule.
 - b. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
 2. Verify detector sensitivity below with manufacturers selected.
 3. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
 4. Smoke detectors shall be ASD-PL3
- C. Coordinate paragraph and subparagraphs below with Drawings for power supply and FACP connections.

Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:
 - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b. Verify detector sensitivity below with manufacturers selected. Increased and decreased sensitivities are available to meet special environmental requirements.
 - c. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
2. Retain subparagraph and associated subparagraphs above for photoelectric smoke detectors or first subparagraph and associated subparagraphs below for ionization smoke detectors. If both types are required, indicate detector types on Drawings.
3. UL 268A listed, operating at 24-V dc, nominal.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
5. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
6. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
7. Integral Visual-Indicating Light: LED type. Indicating status. Provide remote status and alarm indicator and test station where indicated.
8. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
9. Each sensor shall have multiple levels of detection sensitivity.
10. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
11. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
12. Duct detectors shall be DNR

2.6 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system

connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
2. Where called for on plans to have a wire guard, provide and install a welded wire screen guard of appropriate size. Polycarbonate or other transparent protective covers are prohibited.

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 (3 m) from the horn.

- C. 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- (25-mm-) high letters on the lens.
 1. Retain one of two subparagraphs below to suit Project or revise light output to comply with NFPA 72 and ADA minimum requirements. Delete first subparagraph if rated light output is indicated on Drawings. See Editing Instruction No. 11 in the Evaluations.
 2. Rated Light Output: as indicated.
 3. Strobe Leads: Factory connected to screw terminals.
 4. Where called for on plans to have a wire guard, provide and install a welded wire screen guard of appropriate size. Polycarbonate or other transparent protective covers are prohibited.

2.7 SPRINKLER SYSTEM REMOTE INDICATORS

- A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.8 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 (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
 3. Rating: 24-V dc.
- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush cabinet, NEMA 250, Class 1.
- B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LED's permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall where indicated to a circuit-breaker shunt trip for power shutdown and to release doors.

2.11 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, transmits a number for a remote central station. When contact is made with the central station(s), the signal is transmitted. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
- C. All panels shall report to a UL listed central station via AES RADIO

2.12 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
- B. Factory fabricated and furnished by manufacturer of the device.
 - 1. Finish: Paint of color to match the protected device.

2.13 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, not less than No. 18 AWG 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. Line-Voltage Circuits: No. 12 AWG, minimum.
- D. All wire and cable shall be installed in conduit.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Smoke or Heat Detector Spacing:
 - 1. Smooth ceiling spacing shall not exceed [30 feet (9 m)] .
 - 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
 - 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

HVAC: Locate detectors not closer than 3 feet (1 m) 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. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

Audible Alarm-Indicating Devices: Install between 80" and 96" above finished floor, this height is to the visual lens portion of the device, or on ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

- F. Visible Alarm-Indicating Devices: Install integral to each alarm horn if noted.
- G. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- H. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- I. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
- J. Fire alarm document cabinet shall be located adjacent to the fire alarm control panel or at another location that has been approved by the AHJ. If not located at the fire alarm

control panel, the exact location shall be identified on the fire alarm control panel.

3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."
 - 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. 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. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.
- D. 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.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. 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.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 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 CIRCUIT."
- D. The location of the branch-circuit overcurrent protective devices shall be permanently identified at the fire alarm control unit.

3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 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. Testing Agency: Owner will engage a qualified testing and inspecting agency to witness field tests and inspections and prepare test reports. The contractor shall provide all personnel for this test. There shall be two tests, one prior to the Fire Marshall test and one with the Fire Marshall.
- C. 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. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters.
 - 3. 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.
 - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
 - 5. Test and Inspection Records: Prepare according to NFPA 72.
- D. At no time shall the contractor make changes to the documents without written permission from the Engineer.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures and Demonstration and

Training."

END OF SECTION 283100