STATE OF KANSAS

BID & CONSTRUCTION DOCUMENTS

KANSAS BUREAU OF INVESTIGATION

FORENSIC LABORATORY

RENOVATION PHASE II

BLDG NO.: 08300-00002

GREAT BEND, KANSAS

A-014835REV

AUGUST 2024

STATE OF KANSAS
DEPARTMENT OF ADMINISTRATION
OFFICE OF FACILITIES & PROPERTY MANAGEMENT

SET NO. _____

SCOTT SMITH, SENIOR PROJECT MANAGER
GLMV ARCHITECTURE
1525 E. DOUGLAS AVE
WICHITA, KANSAS 67211
PHONE: 316-265-9367
E-MAIL ADDRESS: scott.smith@glmv.com

Kansas Bureau of Investigation
KBI Forensic Laboratory Renovation
Phase 2
Great Bend, Kansas

Office of Facilities and Procurement
Management No. A-014835Rev

Architect
GLMV Architecture, Inc.

Mechanical Engineer
Brack & Associates
Consulting Engineers, P.A

Electrical Engineer
Brack & Associates
Consulting Engineers, P.A

Plumbing Engineer
Brack & Associates
Consulting Engineers, P.A

August 19, 2024

A-014835Rev
KANSAS BUREAU OF INVESTIGATION
KBI FORENSIC LABORATORY RENOVATION

MECHANICAL / ELECTRICAL

The documents intended to be authenticated by my seal are limited to:

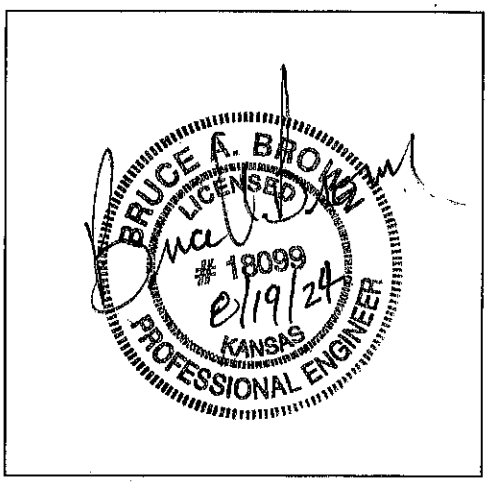
Specifications: Division 22, 23 and 26 all Sections

Drawing Sheets: ME100, PB00, PB01, P100-2, P101-2, MB00-2, MB01-2, M100-2, M101-2, M201-2, M300, M301, M400, M401, M402, EB01-2, E100-2, E101-2, E201-2, E301-2, E302-2, E400, E401, E500, E501 and E502

I hereby disclaim any responsibility for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part of the project.

By: _____

Brack & Associates



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DOCUMENT A - NOTICE TO BIDDERS

PART 1 - GENERAL

1.1 ANNOUNCEMENT OF REQUEST FOR BIDS:

A. The Secretary, Department of Administration announces his request that Bids be submitted for the following construction:

KANSAS BUREAU OF INVESTIGATION
FORENSIC LABORATORY
RENOVATION PHASE II
BUILDING NUMBER: 08300-00002
GREAT BEND, KANSAS 67530
A-014835Rev

B. Award, when made, will be single Contract for the "Project as a whole" including all Work for total construction.

1.2 RECEIVING, PUBLIC OPENING AND READING OF BIDS:

A. The Office of Procurement and Contracts will receive mailed, delivered or emailed bids per instructions below:

1. Sealed bids to include mailed or delivered will be received by the Office of Procurement and Contracts, Department of Administration, Suite 451S, 900 S.W. Jackson Street, Topeka, Kansas 66612 until 2:00 p.m. (local time) on **September 19, 2024.**

2. Emailed bids shall be submitted to procurement@ks.gov. All bids submitted via email/electronically must be received by the Office of Procurement and Contracts, Landon State Office Building at 900 SW Jackson, Suite 451S, Topeka, KS 66612 by the specific bid closing date and time of 2:00 PM CT.

B. All bids will be publicly read as needed via telecom or via Teams after the specified Event bid date and time beginning at 2:30 pm CST.

1. Call in (audio only): +1 785-414-8630, 780766580# United States, Topeka, KS Phone conference ID: 780 766 580#

2. **Microsoft Teams**
Join the meeting now
Meeting ID: 251 517 806 960
Passcode: n7Dv2M

3. In the Lobby of the Office of Procurement at 900 SW Jackson, Suite 451S, Topeka, KS 66612 by the specific bid closing date and time of 2:00 PM CT.

1.3 ELECTRONIC BID DOCUMENTS:

A. All parties interested in obtaining bid documents are responsible for registering on the Integrated Digital Technologies (IDT) website: https://kansasdfm.geocivix.com/secure/.

B. Bidders may view the bid documents on the IDT website, download the bid documents for viewing or printing “in-house” or have the electronic files sent to a printing company of their choice.

C. Bidders will be solely responsible for the cost of printing the bid documents. OFPM will not issue any printed bid documents for bidding.

D. Only parties registered on the IDT website for a project will receive issued Addendums.

E. All tiers of bidders are responsible for understanding the full scope of work covered by the bid documents.

F. Upon award of a contract, the Contractor will be provided up to ten (10) sets of printed bid documents. The contractor is responsible for picking up the bid documents or paying for them to be shipped.

1.4 OBTAINING INFORMATION FOR BIDDERS:

A. Only parties registered on the IDT website for a project will receive issued Addendums.

B. All tiers of bidders are responsible for understanding the full scope of work covered by the bid documents.

C. Upon award of a contract, the Contractor will be provided up to ten (10) sets of printed bid documents. The contractor is responsible for picking up the bid documents or paying for them to be shipped.

1.5 OBTAINING INFORMATION FOR BIDDERS:

A. Questions concerning the Instructions to Bidders, Form of Contract, Insurances and Bonds shall be addressed to the Office of Procurement and Contracts, Department of Administration, Suite 451S, 900 S.W. Jackson Street, Topeka, Kansas 66612, telephone **(785) 296-0002**.

B. **If there is a disclaimer of any responsibility by the Project Architect/Engineer for construction documents other than those specifically authenticated by their seal, it in no way waives their contractual obligation to coordinate all the construction documents on the project.** Questions concerning the Construction Contract Documents (Drawings and Specifications) shall be addressed to the Design Team at:

SCOTT SMITH, SENIOR PROJECT MANAGER
GLMV ARCHITECTURE
1525 E. DOUGLAS AVE
WICHITA, KANSAS 67211
PHONE: 316-265-9367
E-MAIL ADDRESS: scott.smith@glmv.com

1.6 BID RESULTS:

A. **Bid results will not be given to individuals over the phone. Bid results may be obtained under the Kansas Open Records Act by submitting an open records request to the Kansas Department of Administration. Open records requests to the Kansas Department of Administration may be submitted online at https://admin.ks.gov/offices/chief-counsel/kansas-open-records-act, by sending an email to DOA_KORA@ks.gov, or in writing to Attn: KORA 1000 SW Jackson St., Suite 500, Topeka, KS 66612.**

B. Bid results may also be obtained from the Office of Facilities and Property Management; Design, Construction & Compliance. Results will be available three (3) working days after the bid opening by accessing the on-line planroom at https://kansasdfm.geocivix.com/secure/.

END OF DOCUMENT A

DOCUMENT B - INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 METHOD OF BIDDING AND AWARDING:

A. Bids must be submitted on the Form of Bid issued with each set of Construction Contract Documents.

B. A single Contract will be awarded for the "Project as a whole," including the following classification(s) of work:

1. Demolition
2. General
3. Mechanical
4. Electrical
5. Plumbing
6. Security

C. Note: Kansas Statute K.S.A. 75-3741 as amended requires each bidder to list and identify the "major subcontractors" for mechanical and electrical construction as part of the bid when a single Contract for the "Project as a whole" is to be awarded.

1.2 CONTRACTOR PRE-QUALIFICATION

A. This project requires that all contractors wishing to bid as the prime must be pre-qualified by the Office of Facilities and Property Management.

B. For more information on pre-qualification please visit https://admin.ks.gov/offices/facilities-property-management/design-construction--compliance and follow the links to contractor pre-qualification or call (785) 296-8899.

C. Bids submitted by contractors not pre-qualified will be returned to the bidder unopened.

1.3 BIDDER QUALIFICATIONS:

A. Any or all bidders may be required by the Director, Procurement and Contracts to furnish information to support the bidder's capability to comply with conditions for bidding and to fulfill the Contract if awarded the Contract. Such information may include, but not be limited to, the following:

1. Proof of registration with the Kansas Director of Taxation by non-resident Bidders (K.S.A. 79-1009).
2. Proof of registration with the Kansas Secretary of State by foreign corporations.
3. List of projects of comparable size and type the bidder has constructed or in which the bidder has been engaged in a responsible capacity.
4. Evidence the bidder maintains a permanent place of business.
5. A current financial statement.
6. Contractor's Compliance Report and Plan of Action in accordance with provisions of the Kansas Act Against Discrimination (K.S.A. 1978, Supp. 44-1030 and 44-1031).
7. When applicable, provide proof of bidder's authorization for removal, handling and disposal of friable asbestos containing material by attachment of a copy of the Kansas Department of Health and Environment's license to perform said activities. (Ref. K.S.A. 65-5301 et seq.)

1.4 EXAMINATION OF DOCUMENTS AND SITE:

A. Before submitting a bid, each bidder shall carefully examine all Construction Contract Documents pertaining to the work and visit the location of the work to verify conditions under which the work will be performed. Submission of a bid will be considered presumptive evidence the bidder is conversant with local facilities and difficulties, requirements of the Construction Contract Documents and pertinent State and/or local codes and the labor and material markets and that he has made due allowances in his bid for all contingencies. Failure to visit the location of the work may be grounds to reject a bid.

B. Include in bid all costs for labor, materials, equipment, fees, taxes, insurances and other contingencies, with overhead and profit, as necessary to produce a complete installation of the work specified under headings covered by the bid (including all trades specified) without further cost to the Owner.

1.5 PROJECT DOCUMENTS:

A. The Project documents consist of the following items:

1. Document A - Notice to Bidders
2. Document B - Instructions to Bidders
3. Document C - Form of Bid
4. Document D - General Conditions of the Contract (DA-144)
5. Document E - Supplemental General Conditions
6. Document F - Form of Contract (executed)
7. Document G - Form of Performance Bond (executed)
8. Document H - Form of Public Works Bond (executed)
9. Document I - Form of Appointment of Process Agent by Nonresident Contractor (executed)
10. Drawings (when included)
11. Technical Specifications
12. Addenda to Drawings and/or Specifications, duly issued
13. Bid Guaranty
14. Proof of required insurance coverages
15. Notice to Proceed
16. Change Orders
17. Laws and regulations
18. Certificate of Project Completion
19. Project Guarantee
20. Code Footprint
21. Certificate of Occupancy

1.6 INTERPRETATION OF PROJECT DOCUMENTS:

A. Should a bidder find discrepancies in or omissions from the Specifications and/or Drawings, or if there is doubt as to their meaning, the bidder shall advise the Project Architect/Engineer at once.

B. Requests for **clarifications and interpretations** of the Construction Contract Documents (Technical Specifications and Drawings) shall be presented to the Project Architect/Engineer in writing at least ten (10) days prior to the date on which bids are to be opened.

C. **Clarifications and interpretations** of the Construction Contract Documents will be made **only** by Addenda issued to all known persons having same. The Project Architect/Engineer, state agency personnel or Procurement and Contracts will not be responsible for providing **any other** explanation or interpretation of the Construction Contract Documents.

D. Any clarification or interpretations of the meaning of the Drawings, Specifications, or other pre-Bid Documents made orally to any Bidder shall not be used by the bidders in preparation of a bid amount unless confirmed in writing via an addendum

E. Receipt of all Addenda shall be acknowledged on the Form of Bid and upon execution of the Contract, all addenda will become a part of the agreement.

1.7 BID AND PERFORMANCE GUARANTY:

A. Each bid submitted in connection with this Project shall be accompanied by a certified check, cashier's check or bid bond in the amount of five percent (5%) of the base bid, payable without condition to the State of Kansas.

B. The bid bond shall be accompanied by a Power of Attorney showing the authority of the person executing the bond on behalf of the Surety Company and should be approved by the Director, Procurement and Contracts prior to opening of bids.

C. An annual bid bond on file with the Director, Procurement and Contracts, may be acceptable for this transaction providing it is equal to or greater than five percent (5%) of the base bid and is payable without condition to the State of Kansas. This bond must be accompanied by a Power of Attorney showing the authority of the person executing the bond on behalf of the Surety Company.

Note: Use of an annual bid bond must be approved by the Director, Procurement and Contracts a minimum of five (5) days prior to the opening of bids. The Director of Procurement and Contracts may disapprove the use of an annual bid bond if said bond is being used as a bid guaranty on more than one (1) project at the same time.

D. In the event of an award, the responsible bidder offering the lowest bid price meeting Specifications will be required to enter into a Contract and provide proof of insurance in the amount required for the project. Said bidder shall also provide a Performance Bond for the full amount of the Contract. In addition, the bidder will be required to furnish a Public Works Bond for a project of $100,000 or greater, for the full amount of the contract. A Certificate of Deposit, in an amount of 100% of the Contract amount, may be substituted for a Performance and Public Works Bond. All the above documents must be completed and returned within fifteen (15) calendar days after their receipt. Failure to return these documents within the required time period may cause a cancellation of the award and a forfeiture of the full amount of the bid guaranty. Procurement and Contracts may also suspend a bidder from bidding State construction work for six (6) months for failure to comply with this section.

E. Bond forms will be provided by Procurement and Contracts and must be executed with a surety company licensed to do business in the State of Kansas.

F. Bid Guaranties (submitted by certified or cashier's checks) will be returned to unsuccessful bidders when the successful bidder is determined and a Contract executed. The Bid Guaranty of the successful bidder will be returned when the contract, required Bonds and Insurances are furnished and accepted by Procurement and Contracts. Bid guaranties submitted in the form of a certified or cashier's check will be returned on a State of Kansas warrant.

1.8 APPOINTMENT OF PROCESS AGENT BY NONRESIDENT CONTRACTOR:

A. Pursuant to provisions of K.S.A. 16-113, as amended, a nonresident individual, partnership or unincorporated association, if awarded a Contract, will be required to appoint an agent who is a resident

of Kansas who may receive process in any civil action arising from the Contract.

B. The appointment form will be provided by the Procurement and Contracts and must be executed and filed with the Secretary of State as provided by K.S.A. 60-306 and amendments thereto, with a receipt therefore provided to Procurement and Contracts.

1.9 PREPARATION AND SUBMISSION OF BID:

A. Each bid shall be made on the Form of Bid accompanying these instructions. All blank spaces on the Form of Bid shall be filled in. Quote the prices for alternate bids and unit prices as requested.

B. Bid shall not contain recapitulation of work to be done.

C. Bid shall be presented under sealed cover, plainly marked with title of Agency, Building Name, Project Title, Location and, Project number.

D. Bid must be received by the Director, Procurement and Contracts not later than the scheduled closing time.

E. **Prior to the complete execution of a construction contract this project may be canceled at any time by the State. Neither the State of Kansas nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the project canceled for any reason prior to the complete execution of a construction contract.**

1.10 SIGNING FORM OF BID:

A. Bids which are not signed by the individuals making them shall have attached to them a Power of Attorney evidencing authority to sign the bid in the name of the person for whom it is signed.

B. Bids which are signed for co-partnerships shall be signed by all of the co-partners or by an attorney-in-fact. If signed by an attorney-in-fact, there shall be attached to the bid a Power of Attorney evidencing authority to sign the bid.

C. Bids which are signed for corporations shall have the correct corporate name signed in handwriting or in typewriting and the signature of the president or other authorized officer of the corporation shall be manually written below the written corporate name, above the words "by (signature)." If such a bid is manually signed by an official other than the president of the corporation, a resolution of the board of directors evidencing the authority of the official to sign the bid shall be attached.

D. If bids are signed for any other legal entity, the authority of the person signing for the legal entity shall be attached to the bid.

1.11 SUBCONTRACTS:

A. Bidders must submit the names and addresses of the major subcontractors for the project as identified on the Form of Bid. If awarded a Contract for the project, the names of the subcontractors will be included as part of the contract. Any changes in listed subcontractors shall be subject to approval by the Secretary of Administration. Only one subcontractor may be listed for each category.

B. If project alternates are listed in the Construction Contract Documents, and the choice of major subcontractors is dependent upon the combinations of alternates the Owner elects to include as a part of the work, a separate sheet shall be attached to the Form of Bid designating the different combinations of such major subcontractors.

1.12 MODIFICATIONS OF BIDS

A. All modifications shall be submitted by email to procurement@ks.gov. When making emailed modifications do not submit on Document C – Form of Bid. State only the ADD or DEDUCT amount to be ADDED or DEDUCTED to or from the base bid, alternate bid, or unit price. Do not give a new total price for the selection.

Any changes to listed Subcontractors need to be listed on emailed modification as well.

B. Do not send Certificate of Tax Clearance in with emailed Modifications or as an emailed modification. If not submitted with original bid all bidders and major sub-contractors will have 48 hours after bid openings to submit Certificate of Tax Clearance.

C. Official bid results shall be released when they are available. Bid Tabulations will be posted to the online planroom, https://kansasdfm.geocivix.com/secure/, under their respective projects.

1.13 PUBLIC BID OPENING:

A. On the date and at the hour scheduled for closing, the Director, Procurement and Contracts or an authorized representative will open and read the bids publicly for interested bidders or others who may be present.

B. Information obtained at public openings is preliminary only and it shall not be construed the apparent low bidder has met all conditions and Specifications of the bid.

C. If the state offices in Topeka/Shawnee County should be closed due to inclement weather or any other unforeseen condition and we have a project scheduled to bid, all bid openings will be canceled.

1. The revised bid date will be published when we return to the office and will be issued via an addenda.

2. To find information on state office closings, refer to local media sites. (www.wibw.com and www.kansasfirstnews.com)

1.14 WITHDRAWAL OF BIDS:

A. Any bidder may withdraw a bid at any time prior to the scheduled closing time for receipt of bids, but after the scheduled closing time for receipt of bids, no bid may be withdrawn for a period of **thirty (30)** calendar days subject to the provisions of K.S.A.75-6901 et seq. If a bid is withdrawn after the scheduled closing time, it may result in the forfeiture of all or part of the bid guaranty.

1.15 AWARD OF CONTRACT:

A. A Contract will be awarded to the lowest responsible bidder meeting conditions and specifications imposed in the call for bids, but the Director, Procurement and Contracts reserves the right to accept any or all bids or to reject any or all bids for sufficient reason(s) and to waive all technicalities if deemed to be in the best interest of the State of Kansas.

B. In the event bid Alternates are listed in the bid documents, bidders are advised that the Owner **is not restricted** to selecting Alternates in numerical order as listed on Document C - Form of Bid. The sole intent of this provision is to allow the Agency maximum flexibility to incorporate enhancements into the project.

C. At the time of award, Procurement and Contracts will provide the successful bidder with the Contract Forms, the Performance and Public Works Bond Forms and Appointment of Process Agent Form, if applicable, accompanied by instructions for execution, and will also request submission of proof of certain Insurance coverages.

D. The executed Contract, Bonds, and Insurance documents as well as a receipt for filing the Public Works Bond and the Appointment of Process Agent Form with the Clerk of the District Court in the county where the work is to be performed, must be returned to and received by Procurement and Contracts within fifteen (15) working days.

E. Failure on the part of the Contractor to provide the executed documents within fifteen (15) working days may result in withdrawal of the award, re-awarding to the next lower bidder or rebidding the contract and forfeiture of all or part of the bid guaranty.

1.16 NOTICE TO PROCEED:

A. A Notice to Proceed will be issued by the Office of Facilities and Property Management upon receipt by Procurement and Contracts of the Contractor's signed copy of the Contract and required approved insurance documents.

B. When DCC receives copies of the signed contracts from Procurement and Contracts, DCC will write the Notice to Proceed for contract time to start the next day in accordance with the construction contract stipulations.

C. The Contractor will also be required to submit the required bonds and Appointment of Process Agent Form (if applicable) to Procurement and Contracts. The Contractor will be allowed to proceed prior to receipt of the bonds and Process Agent Form, but no payments will be made until all these documents are submitted. If appropriate bonds are not provided, no payment will be made.

D. The Procurement and Contracts and Office of Facilities and Property Management reserve the right to withhold issuance of a Notice to Proceed until all documents are received if they are uncertain of the Contractor's ability to obtain the required bonds.

E. Prior to the issuance of the Notice to Proceed, the State of Kansas shall not be liable for any expenses relating to the bid or Contract, or any expenses related to their preparation.

1.17 CHANGE ORDERS:

A. Changes to the initial Contract are to be made by the Project Architect/Engineer with the approval of the owner and the Director of the Office of Facilities and Property Management.

1.18 LAWS AND REGULATIONS:

A. All applicable laws of the State of Kansas, municipal ordinances and rules and regulations of all authorities having jurisdiction over construction of this Project shall apply to any Contract resulting from a bid on this Project as though herein written out in full.

1.19 PROJECT CLOSE OUT:

A. When the Contract is satisfactorily complete and authorized by the Owner and the Office of Facilities and Property Management, the Project Architect/Engineer will forward a formal Certificate of Project Completion and an Affidavit of Contractor to the Contractor.

B. The contractor will sign the Certificate of Project Completion and sign/notarize the Affidavit of Contractor to certify that all debts and claims against this project have either been paid in full or otherwise satisfied. The contractor will forward both along with the final application for payment back to the architect/engineer.

1.20 PROJECT GUARANTEE:

A. The date of the Certificate of Project Completion shall be the starting date for the guarantee/warranty period, unless partial occupancy requires an earlier date to be set. In that case the guarantee/warranty period for work and equipment serving the occupied area shall begin on the date the Owner takes partial occupancy of that portion of the project.

1.21 REQUESTS FOR SUBSTITUTION PRIOR TO BID DATE:

A. Should a bidder or a manufacturer's representative wish to incorporate, in the base proposal, brands or products other than those named in the Specifications, he shall submit written request for substitution approval to the Project Architect/Engineer ten (10) calendar days prior to date proposals are due. Approved substitutions will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.

END OF DOCUMENT B

DOCUMENT C - FORM OF BID

PART 1 - GENERAL

SUBMITTED BY:

_____

NAME OF COMPANY (*Please print or type*)

ATTACH CERTIFIED OR CASHIER'S CHECK HERE
IF FURNISHED IN LIEU OF A BID BOND

SUBMITTED TO:

Todd Herman, Director
Procurement and Contracts
Department of Administration
900 S.W. Jackson Street, Suite 451S
Topeka, Kansas 66612

SUBMITTED FOR:

Kansas Bureau of Investigation
Forensic Laboratory
Renovation Phase II
Bldg No.: 08300-00002
Great Bend, Kansas
A-014835Rev

Sir:

In response to your Notice to Bidders and in compliance with the Instructions to Bidders, the undersigned herewith submits his offer to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees and to pay all royalties, fees, permits, licenses, applicable taxes insurances, haulage, storage, superintendency, overhead and profit necessary to complete the following construction work:

BASE BID (LUMP SUM):

For the referenced project and in accordance with the Construction Contract Documents as prepared by the Project Architect/Engineer for a total lump sum price of:

_____

_____DOLLARS ($_____).

ALTERNATE BIDS AND UNIT PRICES:

The undersigned offers for the Owner's consideration and use the following prices for specific alternate bids and unit prices. These prices include all costs to the Owner, including those for labor, materials, equipment, tools of trades and labor, appliances, accessories, warranties, guarantees, royalties, fees, permits, licenses, applicable taxes, insurances, haulage, storage, superintendency, overhead and profit. Alternates are to be added to the above quoted base bid price as noted and may be a negative number.

Bidders are advised that the Owner **is not restricted** to selecting Alternates in numerical order as listed below. The sole intent of this provision is to allow the agency maximum flexibility to incorporate enhancements into the project.

Any change in the alternate and unit price listing will cause a new Form of Bid to be issued.

ALTERNATE NO. 1	BUILDING EAST WING REMODEL	ADD ($_____)
ALTERNATE NO. 2	LAB CASEWORK	ADD ($_____)
ALTERNATE NO. 3	NEW WALL – CHEMICAL STORAGE "110"	ADD ($_____)
ALTERNATE NO. 4	NEW VENTILATED LOCKERS	ADD ($_____)

ALTERNATE NO. 5	NEW INTERIOR WINDOW “W2”	ADD ($_____)
ALTERNATE NO. 6	LAB EQUIPMENT	ADD ($_____)

MAJOR SUBCONTRACTORS:

The undersigned hereinafter identifies as part of this bid the major subcontractors he proposes to use in the performance of work under the contract. If the bidder will perform the work of a subcontractor with his own forces, he must so indicate by writing his company name in the space where the subcontractor would have been listed. If the choice of major subcontractors is dependent upon the combinations of alternates the owner elects to include as a part of the work, a separate sheet shall be attached to the Form of Bid designating the different combinations of such major subcontractors. No change or substitution may be made in the listed subcontractors without the prior approval of the Secretary of Administration. In order to obtain this approval a written request shall be made to the Director of the Office of Facilities and Property Management.

MECHANICAL CONSTRUCTION (List one (1) only)

_____
Name

_____
Address

ELECTRICAL CONSTRUCTION (List one (1) only)

_____
Name

_____
Address

TIME OF COMPLETION:

The undersigned agrees to have the work of the project to a point of final completion, including all punch list items, ready for the Project Architect/Engineer's final inspection and the Owner's and Office of Facilities and Property Management’s acceptance by **May 23, 2025.**

ADDENDA:

The undersigned acknowledges receipt of the following Addenda:

#1(_____) #2(_____) #3(_____) #4(_____) #5(_____) #None(_____)

STATE TAX:

The undersigned attests this Bidder is not in arrears in taxes due the State of Kansas.

This project has been determined by the Kansas Department of Revenue to be subject to Kansas sales tax. The cost of said Tax must be **INCLUDED IN** all Bid and Contract prices. Sales tax includes all applicable state, county and city sales taxes. (Refer to the Supplemental General Conditions, Document E, for instructions on paying the tax.)

FEDERAL TAX:

The undersigned has included in all quoted prices the cost of federal excise tax on all items of construction and equipment subject to said tax.

AGREEMENTS:

The undersigned agrees to the following terms and conditions:

1. An incomplete bid or other information not requested which is written on or attached to this Form of Bid, may be cause for rejection of the bid.

2. For a bid to be considered responsive, every blank must be filled in. Failure to do so may result in the disqualification of the bid.

3. A bid may be considered incomplete and non-responsive that does not indicate a price for any alternate bid or unit price described and identified on the Form of Bid. A typed or printed "no bid" entered in the space provided for an alternate bid or unit price may lead to the bid being considered non-responsive and be grounds for rejection of the bid. A typed or printed "no charge" entered in the space provided for an alternate bid or unit price will be considered a valid bid, as will the figure "0.00."

4. He has read the Notice to Bidders and the Instructions to Bidders carefully.

5. The accompanying bid security (bond) (certified check) (cashier's check) in the amount of:

   _____

   _____ DOLLARS ($_____).

   is payable without condition to the State of Kansas, the sum of which it is agreed will be forfeited as liquidated damages for the delay and extra expense caused the owner if the undersigned fails to execute the Contract and to furnish the bonds and insurances required by the Construction Contract Documents.

6. The Director, Procurement and Contracts reserves the right to reject any or all bids and to waive all technicalities should such action be deemed to be in the best interest of the State of Kansas.

7. The Owner reserves the right to accept or reject any or all alternate bids and unit prices.

8. Subject to the provisions of K.S.A.75-6901 et seq. this bid may not be withdrawn for a period of thirty (30) calendar days following the receipt, opening and public reading thereof.

9. Failure to acknowledge receipt of any addendum issued may be cause for a bid rejection.

10. **Prior to the complete execution of a construction contract this project may be canceled at any time by the State. Neither the State of Kansas nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the project canceled for any reason prior to the complete execution of a construction contract.**

CERTIFICATION REGARDING IMMIGRATION REFORM & CONTROL

All Contractors are expected to comply with the Immigration and Reform Control Act of 1986 (IRCA), as may be amended from time to time. This Act, with certain limitations, requires the verification of the employment status of all individuals who were hired on or after November 6, 1986, by the Contractor as well as any subcontractor or sub-subcontractor. The usual method of verification is through the Employment Verification (I-9) Form. With the submission of this bid, the Contractor hereby certifies without exception that Contractor has complied with all federal and state laws relating to immigration and reform. Any misrepresentation in this regard or any employment of persons not authorized to work in the United States constitutes a material breach and, at the State's option, may subject the contract to termination and any applicable damages.

Contractor certifies that, should it be awarded a contract by the State, Contractor will comply with all applicable federal and state laws, standards, orders and regulations affecting a person's participation and eligibility in any program or activity undertaken by the Contractor pursuant to this contract. Contractor further certifies that it will remain in compliance throughout the term of the contract.

At the State's request, Contractor is expected to produce to the State any documentation or other such evidence to verify Contractor's compliance with any provision, duty, certification, or the like under the contract.

Contractor agrees to include this Certification in contracts between itself and any subcontractors in connection with the services performed under this contract.

By signing this Form of Bid, the Contractor agrees to follow the Immigration and Reform Control Act of 1986 and any and all amendments to the Act.

DECLARATIONS:

The undersigned hereby declares he has carefully examined the Drawings and Specifications, has visited the actual location of the work, has satisfied himself as to all conditions and understands that, in signing this Form of Bid, he waives all right to plead any misunderstanding regarding same and agrees to be bound by the provisions of said Drawings and Specifications and all statements made therein.

The undersigned proposes to enter into Contract and to furnish and pay for the specified bonds and other required documents within fifteen (15) working days after award of the contract.

The undersigned certifies that he does not have any substantial conflict of interest sufficient to influence the bidding process on this bid. A conflict of substantial interest is one which a reasonable person would think would compromise the open competitive bid process.

All bidders and major sub-contractors listed on the bid form shall **not** be in arrears in taxes due the state of Kansas.

1. All bidders and major sub-contractors listed on the Form of Bid must submit with their bid, current **Certificate of Tax Clearance** obtained from the Kansas Department of Revenue. Bidders and listed major sub-contractors can obtain the Certificate of Tax Clearance through the following website: http://www.ksrevenue.org/taxclearance.html .

2. Do not send Certificate of Tax Clearance in with Fax Modifications or as a Fax Modification. If not submitted with original bid all bidders and major sub-contractors will have 48 hours after bid openings to submit Certificate of Tax Clearance.

The undersigned attests this Bidder is not in arrears in taxes due the State of Kansas, has attached Kansas Department of Revenue Certificate of Tax Clearance for the Bidder and all major sub-contractors listed on the Form of Bid, and has attached signed State of Kansas - Tax Clearance Status forms from all listed major sub-contractors.

SIGNATURE AND SEAL:

DATED THIS _____DAY OF _____, 20____ .

_____
LEGAL NAME OF PERSON, FIRM OR CORPORATION

_____
FEDERAL EMPLOYEE IDENTIFICATION NUMBER

_____
MAILING ADDRESS for the above

_____
CITY, STATE and ZIP CODE

_____/_____
TELEPHONE NUMBER FAX NUMBER

_____/_____
CELL PHONE NUMBER E-MAIL ADDRESS

_____
CONTACT PERSON FOR TAX ISSUES

If the bid is submitted
by a Corporation, affix seal here

_____/_____
BY (SIGNATURE) TITLE

BIDDER'S CONTRACTING IDENTIFICATION NUMBER:

To help facilitate the awarding of the Contract and subsequent payment(s) processes, the bidder gives the FEIN (Federal Employers Identification Number) or the SSN (Social Security Number) planned for use when making application for partial or full work compensation. (Use space provided above.)

END OF DOCUMENT

DOCUMENT D - GENERAL CONDITIONS OF THE CONTRACT
DA-144 (3-1-01)

ARTICLE INDEX

1. Definitions
2. Specifications and Drawings
3. Additional Instructions
4. Reference Standards
5. Surveys, Permits and Regulations
6. Shop Drawings and Samples
7. Materials and Workmanship
8. Allowances
9. Inspection and Testing of Materials
10. “Or Approved Substitute” Clause
11. Subsurface & Latent Conditions Found Different
12. Changes in Work
13. Separate Contracts
14. Subcontracts
15. Mutual Responsibility of Contractors
16. Project Architect/Engineer's Authority
17. Duties of the Contractor
18. Protection of Work and Property
19. Receiving and Storing Materials and Equipment
20. Safety
21. Correction of Work
22. Construction Schedule and Reports
23. Time for Completion
24. Right of Owner to Suspend Work
25. Right of Owner to Terminate Contract
26. Bonds
27. Substitute Bonds
28. Sales Tax
29. Quantities of Estimates
30. Payments to Contractor
31. Payments by Contractor
32. Subcontractor Payment Indemnification
33. Acceptance of Final Payment as Release
34. Use and Occupancy Prior to Acceptance
35. General Guarantee
36. Arbitration, Damages, and Warranties
37. Patents and Royalties
38. Indemnification
39. Assignments
40. Required Provisions Deemed Inserted
41. Kansas Acts Against Discrimination
42. Antitrust
43. Optional Performance and Payment Guarantee
44. Simultaneous Execution of Construction Contracts
45. Evaluations
46. Drug Testing
47. Licensure

1. DEFINITIONS

The following terms as used in this contract are respectively defined as follows:

A. The term **Project Architect/Engineer** refers to the Project Architect/Engineer refers to an Architect/Engineer selected by a negotiating committee pursuant to K.S.A. 75-1253 and 75-1257, or any employee of the Department of Administration or a state agency authorized by K.S.A. 75-1254 to act as Project Architect/Engineer for the project.

B. **As directed**, rejected, approved, and other words of similar meaning which authorize any exercise of judgment, shall be distinctly understood to mean that such power to direct, reject, and approve shall be vested only in the Project Architect/Engineer, Owner, and the Office of Facilities and Property Management.

C. **Construction documents** are the detailed drawings, and specifications defining the scope of the work for the design of the project.

D. The **construction representative** or inspector is appointed by and responsible to the Office of Facilities and Property Management. He inspects capital improvement projects ensuring construction is in accordance with approved code footprints, building codes and accessibility laws.

E. **Contract**: The agreement between the Contractor and the Owner covering the work to be done.

F. CONTRACT DOCUMENTS

1. The **Contract Documents**, enumerated in the table of contents of this project manual shall form a part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were fully set forth.

2. The **Contract Documents** are complementary, and what is required by one shall be as binding as if required by all. The intention of the documents is to include all labor, materials and equipment necessary for the proper execution of the Work.

3. **Contract Documents** consist of the Notice to Bidders, Instructions to Bidders, Form of Bid, Contractor's Performance Bond, Contractor's Public Works Bond to the State, the Contract, General Conditions, Supplemental General Conditions, Specifications, Drawings, Maps, Plats, etc., prepared or furnished by the Project Architect/Engineer, and Addenda, including additions and/or modifications therein incorporated before the execution of the Contract. Contract Documents shall also include written clarifications, Change Orders and written interpretations by the Project Architect/Engineer which are made after execution of the Contract which are not included in Change Orders.

G. The **Contractor** is a person, firm or corporation with whom the Contract is made by the Owner.

H. The **Contractor's superintendent** is the Contractor's chief representative at the Project site or related work area.

I. The **Director** is the head of the Office of Facilities and Property Management and, under certain delegated authority, acts on behalf of the Secretary of Administration.

J. The **Office of Facilities and Property Management** is a unit of the Department of Administration of the State of Kansas authorized to administer, enforce or interpret laws relating to construction on state property.

K. **Final Project Completion** is the date upon which the Contractor shall be completed with all punch list items to the satisfaction of the Owner, Project Architect/Engineer and Office of Facilities and Property Management and all systems are fully tested, balanced, corrected and functional. **Final** completion is to occur on or before the adjusted contract completion date. It is at this point that the Contractor may apply for final payment of the contract sum at which point a Certificate of Project Completion shall be written.

L. The **Owner** is the State agency, representing the State of Kansas, with whom the agreement with the contractor is executed.

M. The **Owner's Representative** is the person(s) appointed by and responsible to the Owner. He acts on behalf of the Owner in matters relating to the execution of the contract.

N. **Partial Occupancy** (for phased projects only) is the date that a separate wing or portion of the building receives final completion as designated above.

O. Wherever the word "**Plan**" is used, the word "Drawing" may be substituted, and vice versa.

P. The **Prime Contractor** is that Contractor identified in the Contract to serve as coordinator and director of all work when separate contracts are awarded for different portions of the project.

Q. The term "**provide**" shall be interpreted to mean, "furnish and install in place."

R. A **Subcontractor** is a person or organization who has a contract with the Contractor to perform any of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative. A lower-tier Subcontractor is a person or organization who has a contract with a Subcontractor or another lower-tier Subcontractor to perform any of the Work at the site. Nothing contained in the Contract Documents shall create contractual relationships between the Owner or the Project Architect/Engineer and any Subcontractor or lower-tier Subcontractor, of any tier.

S. **Substantial completion** is the point at which the Owner, Office of Facilities and Property Management, and the Project Architect/Engineer agree the work, or a designated portion thereof, is sufficiently complete so that the Owner may occupy or use the premises for its intended purpose. Substantial completion will not occur until all items relating to fire exiting, notification, detection, separation or suppression on the fire code footprint of record are completed.

T. The term **"supplier**" also is applicable to those furnishing materials, equipment or supplies to be incorporated in the project whether work performed is at the site or in the factory, or both.

U. A **suitable warehouse** shall be approved by the Project Architect/Engineer, and Owner's Representative and

must comply with the following.

1. The facility shall be an independent, commercial warehouse not owned by the Contractor or Supplier.

2. The facility must have established material warehousing procedures.

3. The warehouse shall be located within an acceptable distance of the project site, as established by the Project Architect/Engineer, and Owner's Representative.

4. The Project Architect/Engineer and Owner's Representative shall be provided with all documentation required by Article 30 - Payments to Contractor.

5. All materials for the Owner's project must be stored in the name of Owner.

V. **Surety:** Approved surety bound with and for the Contractor to insure his acceptable performance of the Contract and for his payment of all obligations under the Contract.

W. The term "**Work**" includes all labor necessary to complete the construction required by the Contract Documents for this Contract, and all materials, equipment and supplies incorporated or to be incorporated in such construction.

X. **Written notice** will be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, if delivered at or sent by mail to the last business address shown to the party giving notice, or if transmitted via e-mail or facsimile to the e-mail address or facsimile number provided by the firm or entity.

2. SPECIFICATIONS AND DRAWINGS

A. These Specifications are of an abbreviated form and contain incomplete sentences. Omissions of words or phrases such as "the Contractor shall," "shall be," "as noted on the Drawings," "according to the Drawings," "a," "an," "the" and "all" are intentional. Omitted words and phrases shall be supplied by inference in the same manner as when "note" occurs on the Drawings.

B. Owner, Contractor, Project Architect/Engineer, are those mentioned as such in the Contract Documents. They are treated throughout the Contract Documents as if each were of singular number and masculine gender.

C. Specifications are separated into titled divisions for convenience of reference, and to facilitate letting of contracts and subcontracts. Such separations will not, however, operate to make the Project Architect/Engineer an arbiter to establish limits of subcontracts or to establish jurisdiction.

D. The drawings, herein referred to consist of drawings prepared by the Project Architect/Engineer and are identified and incorporated in these Contract Documents.

E. Drawings are intended to show general arrangements, design, and extent of work and are partly diagrammatic. As such, they shall not be scaled.

F. Details take precedence over smaller scale general drawings.

G. In case of conflict between drawings and specifications, or between drawings and other drawings, the project architect is to be contacted for clarifications.

H. Any specific provision in any of the Contract Documents which may be in conflict or inconsistent with any of the articles in these General Conditions or the Supplementary General Conditions shall be controlling for that specific project.

I. Should conflicts in Contract Documents occur, either in quality or quantity of work required, the Contractor shall, unless clarification has been issued by addenda prior to receipt of bids, furnish, and install work in accordance with either of the conflicting provisions of the documents as the Project Architect/Engineer may direct.

J. If the Contractor observes that drawings and specifications are at variance with any laws, ordinance, rules, regulations, or codes applying to the Work, he shall promptly notify the Architect Owner, and Office of Facilities and Property Management in writing, and any necessary changes will be adjusted as provided in Contract Documents. However, it is not the responsibility of the Contractor to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes, and regulations.

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

L. Drawings consist of sheets enumerated in these Contract Documents and of such detailed drawings and instructions as will be provided during the progress of the Work, to fully explain and carry out the requirements of these specifications and the drawings.

M. Drawings, specifications, and copies thereof furnished by the Owner are and shall remain its property. They are not to be used on another project and, with the exception of one contract set for each party to the Contract, shall be returned to the Owner's Representative on request, at the completion of the Work.

3. ADDITIONAL INSTRUCTIONS

A. The Contractor may be furnished additional instructions, clarifications, and/or detail drawings by the Project Architect/Engineer as necessary to carry out the intent of the Work included in the Contract. The additional Drawings and/or instructions thus supplied will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry out the Work in accordance with the additional detail drawings and/or instructions.

4. REFERENCE STANDARDS

A. For products or workmanship specified by association, trade or Federal standards, comply with requirements of the standard, except when more rigid requirements are specified.

B. Obtain copy of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification from the Project Architect/Engineer before proceeding.

D. References to known Standard Specifications mean and intend the latest edition of said Specifications adopted and published as of the date of invitation to submit Bids. References to technical society, organization or body are made in the Specifications.

E. Codes, industry standards and guidelines referenced in the Contract Documents include but are not limited to the following acronyms:

ADAAG	Americans with Disabilities Act Accessibility Guidelines
ACI	American Concrete Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute (all publications)
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration & Air-Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWI	Architectural Woodwork Industry
AWSC	American Welding Society Code
CBM	Certified Ballast Manufacture
FM/IRI	Factory Mutual/Insurance Rating Institute
GCEHMF	Guidelines for Construction and Equipment of Hospital and Medical Facilities
IBC	International Building Code
ICEA	Insulated Cable Engineers Association

IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
IFGC	International Fuel Gas Code
IMC	International Mechanical Code
IPC	International Plumbing Code
JCAHO	Joint Commission on Accreditation of Healthcare Organizations
	Kansas Boiler Safety Act Rules and Regulations
LSC	Life Safety Code
MRCA	Midwest Roofing Contractors Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NIST	National Institute of Standards & Technology
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety and Health Act
SIGMA	Sealed Insulating Glass Manufacturers Association
SMACNA	Sheet Metal Air Conditioning National Association
UL	Underwriters Laboratories, Inc.

5. SURVEYS, PERMITS AND REGULATIONS

A. If additional site information is required beyond that shown in the Contract Documents, the Contractor shall be responsible for all site, topography and property surveys not provided.

B. The Contractor shall pay all fees and shall procure all applications, permits, licenses and approvals necessary for the execution of his Contract. See K.S.A. 75-3741c.

C. The Contractor shall give all notices and comply with all State and Federal laws, codes, rules and regulations relating to the performance of the Work, the protection of adjacent property, and the maintenance of passageways, guard fences or other protective facilities.

D. If charges for water, sewer and other utility connections made by municipalities are costs which the State is obligated to pay, the Contractor shall pay these charges where required by the Specifications.

6. SHOP DRAWINGS AND SAMPLES

A. Shop drawings shall consist of drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any Subcontractor, manufacturer, supplier or distributor, and which illustrate some portion of the work.

1. All shop drawing submittals shall be accompanied by a transmittal letter identifying the project and listing each item being submitted. Each item submitted shall be identified by reference to the Project identification number, Specifications number and/or Drawing sheet numbers.

2. Contractor shall submit to the Project Architect/Engineer a list of shop drawings and a tentative submittal schedule prior to the first partial payment. Submittal schedule must be updated if requested.

3. All subcontractors, material or equipment suppliers shall submit through the Contractor shop drawing items comprising brochures, manufacturer's catalog sheets and data specifications. After the Project Architect/Engineer's approval, one (1) copy shall remain on file with the Project Architect/Engineer, one (1) copy shall be transmitted to the Office of Facilities and Property Management, one (1) copy shall be sent to the Owner, one (1) copy shall be kept on file in the Contractor's job. In addition to the distribution listed above, the contractor shall determine the number of additional copies required for construction use, including subcontractors and suppliers. Additional copies that may be required for the project shall be identified at the pre-construction conference. Contractor shall distribute the construction copies as required.

B. Samples shall consist of physical examples furnished by the Contractor in sufficient size and quantity to illustrate materials, equipment or workmanship, and to establish standards by which the work will be judged. Samples shall be submitted on items called for in the Specifications or as requested by the Project

Architect/Engineer.

1. Submit samples in sufficient quantity to permit Project Architect/Engineer to make all necessary tests and of adequate size to show quality, type, color range, finish, and texture. Label each sample stating materials, type, color, thickness, size, project name, identification number, and Contractor's name.

2. Submit transmittal letter requesting approval, and prepay transportation charges to Architect/ Engineer's office on samples forwarded.

3. Materials installed shall match approved samples.

C. The Contractor shall review shop drawings and samples and shall place his stamp and/or signature thereon as evidence that he has checked each item, and shall submit same with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the work of any other Contractor. The Contractor shall inform the Project Architect/Engineer in writing of any deviation in the shop drawings or samples from the requirements of the Contract Documents. Contractor shall be responsible for all corresponding changes due to deviations in details, dimensions, and costs involved with other trades.

D. By stamping and submitting shop drawings and samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers, and similar data, and that he has checked and coordinated each shop drawing and sample with the requirements of the work and of the Contract Documents. Drawings not so noted will be returned without being examined by the Project Architect/Engineer.

E. The Project Architect/Engineer will review and approve shop drawings and samples with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. The Project Architect/Engineer's approval of a separate item shall not indicate approval of an assembly in which the item functions, nor shall the Project Architect/Engineer's approval relieve the Contractor from responsibility for errors or omissions in shop drawings or samples.

F. The Contractor shall make any corrections required by the Project Architect/Engineer and shall resubmit the required number of corrected copies of shop drawings or new samples until approved. Resubmitted items shall be identified as such on the items and the transmittal letter.

G. The Contractor shall direct specific attention in writing on resubmitted shop drawings to revisions other than the corrections requested by the Project Architect/Engineer on previous submissions. Corrections or changes indicated on shop drawings shall not be considered an extra work order.

H. No work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Project Architect/Engineer. All such work shall be in accordance with approved shop drawings and samples.

I. The Contractor shall keep on the site of the Work, an approved or confirmed copy of the shop drawings, Drawings and Specifications, and shall at all times give the Owner access thereto.

J. All drawings for any one Contract should be numbered consecutively and shall bear the name, project identification number, and location of the project, the name of the Contractor, the date of the drawing, and the date of each correction or revision.

K. The Contractor submitting late, inadequate or incorrect shop drawings shall be responsible for damages and delays should submittals be rejected by the Project Architect/Engineer.

7. MATERIALS AND WORKMANSHIP

A. Materials and fixtures shall be new and of latest design and current manufacture unless otherwise specified as approved by the Project Architect/Engineer. All Work shall be performed by competent workers and shall be of best quality.

B. The Contractor shall carefully examine the plans and specifications and shall be responsible for the proper fitting of his material, equipment, and apparatus into the building.

C. The Contractor shall base his bid only on the Contract Documents. Contractor may make a written proposal

to the Project Architect/Engineer to use alternate materials or fixtures, but the Project Architect/Engineer's decision shall be final. Refer to Article 10 - "Or Approved Substitute" Clause.

D. Should the Contract Documents fail to adequately describe materials or goods to be used, it shall be the duty of the Contractor to inquire of the Project Architect/Engineer what is to be used and to supply it at the Contractor's expense or else thereafter replace it to the Project Architect/Engineer's satisfaction. As a minimum, the Contractor shall provide the quality of materials as generally specified throughout the Contract Documents.

E. Materials and workmanship shall be subject to inspection, examination, and test by the Project Architect/Engineer, the Construction Representative and the Owner's Representative at any and all times during manufacture, installation, and construction on any of them, at places where such manufacture, installation, or construction is carried on. The Project Architect/Engineer shall have the authority and right to reject defective materials and workmanship or to require correction.

F. Materials prohibited by governmental authority or regulation from being used in construction shall not be used on this project.

G. The Contractor shall promptly remove, at his expense, all rejected materials from work site.

H. When a material has been approved, no change in brand or make will be permitted unless:

1. Manufacturer cannot make satisfactory delivery, or

2. Material delivered fails to comply with contract requirements.

3. No change can be made without the Project Architect/Engineer's approval

I. In order that ready availability of materials, parts, or components for repair, replacement, or expansion may be assured, all such materials, parts and components shall be obtained where feasible from sources which maintain a regular, domestic stock.

J. Reference to "standard" specifications of any association or manufacturer, or codes of State authorities, refers to the most recent printed edition or catalog in effect on the date which corresponds with date of the Contract Documents.

K. Whenever reference is made in the Specifications that work shall be "performed," "applied," "installed," "finished," "tested," or "connected," in accordance with the "manufacturer's directions or instruction," the Contractor to whom those instructions are directed shall furnish printed copies of such instructions when requested by the Project Architect/Engineer before execution of the work.

8. ALLOWANCES

A. The Contractor shall include in the contract sum all allowances stated in the Contract Documents. Items covered by these allowances shall be supplied for such amounts and by such persons as the Owner may direct, but the Contractor will not be required to employ persons against whom he makes a reasonable objection.

B. Unless otherwise provided in the Contract Documents:

1. These allowances shall cover the cost to the Contractor, less any applicable trade discount, of the materials and equipment required by the allowance delivered at the site, and all applicable taxes;

2. The Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the original allowance shall be included in the contract sum and not in the allowance;

3. Whenever the cost is more than or less than the allowance, the contract sum shall be adjusted accordingly by Change Order, the amount of which will recognize changes, if any, in handling costs on the site, labor, installation costs, overhead, profit and other expenses.

9. INSPECTION AND TESTING OF MATERIALS

A. All work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records shall be made available by the Contractor to authorized representatives and agents of State government.

B. If a portion of the Work is covered contrary to the Project Architect/Engineer's request or to requirements specifically expressed in the Contract Documents, it shall, if required in writing by the Project Architect/Engineer or the Owner's Representative, be uncovered for the Architect's observation and be replaced and recovered at the Contractor's expense with the proper personnel in a timely manner as approved by the Owner, without change in the Contract Time.

C. If a portion of the Work has been covered which the Architect or the Owner's Representative has not specifically requested to observe, prior to its being covered, the Project Architect/Engineer or the Owner's Representative may request to see such Work, and it shall be uncovered by the Contractor who will furnish the necessary facilities, labor and materials. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner will be responsible for payment of such costs.

D. Unless otherwise provided, Contractor shall provide all testing as outlined in the Contract Documents by approved independent testing agencies. Copies of tests reports shall be sent to Office of Facilities and Property Management, the Owner, and the Project Architect/Engineer and the Contractor by the testing agency.

E. If any work is required to be specially tested or approved, the Contractor shall give the Project Architect/Engineer, Construction Representative and the Owner's Representative a minimum of five working days notice of date for such inspection. Such materials and equipment requiring testing, shall be tested in accordance with accepted or specified standards, as applicable. Unless otherwise called for in the Specifications, the laboratory or inspection agency shall be accepted by the Project Architect/Engineer and the Contractor will pay all costs incurred by the specified testing and laboratory procedures. Should retesting be required, due to failure of initial testing, the cost of such retesting shall be borne by the Contractor.

F. The cost of any testing performed by manufacturers or contractors for the purpose of substantiating acceptability of proposed substitution of materials and equipment, or the necessary conformance testing in conjunction with manufacturing processes or factory assemblage, shall be borne by the Contractor or manufacturer responsible.

G. On the basis of the test results, materials, equipment, or accessories may be rejected even though general approval has been given. If items have been incorporated in the Work, the Project Architect/Engineer will have the right to cause their removal and replacement, without cost to the Owner, by items meeting contract requirements or to demand and secure such reparation to the Owner from the Contractor as is equitable.

H. The Project Architect/Engineer reserves the right to require the Contractor to furnish a certificate guaranteeing that material or equipment as submitted complies with contract requirements. If statement originates with manufacturer, the Contractor shall endorse all claims and submit statement in his own name.

10. "OR APPROVED SUBSTITUTE" CLAUSE

A. Whenever, in the Contract Documents any article, appliance, device, or material is designated by the name of a manufacturer, vendor, or by any proprietary or trade name, the words "or approved substitute", shall automatically follow and shall be implied unless specifically indicated otherwise. The standard products of manufacturers other than those specified will be accepted when, it is proven in writing via product literature to the satisfaction of the Project Architect/Engineer they are equal in design, spare parts availability, strength, durability, usefulness, serviceability, operation cost, maintenance cost, and convenience for the purpose intended. The written product literature shall include information to allow a complete comparison of the proposed product. Any changes required in the details and dimensions indicated in the Contract Documents for the substitution of standard products other than those called for shall be properly made and approved by the Project Architect/Engineer at the expense of the Contractor requesting the substitution or change. No substitutions will be permitted for components of extensions to existing systems when, in the opinion of the Project Architect/Engineer, the named manufacturer must be provided in order to insure compatibility with the existing systems, including, but not limited to, fire alarms, smoke detectors, controls, etc.

B. No substitution shall be purchased or installed by the Contractor without the Project Architect/Engineer's written approval. Requests for approval of substitutions must be made in a timely manner. (See applicable section of the “Instructions to Bidders”).

C. It shall be understood that the use of materials or equipment other than those specified, or approved substitute by the Project Architect/Engineer, shall constitute a violation of Contract, and that the Project Architect/Engineer shall have the right to require the removal of such materials or equipment and their replacement with the specified materials or equipment at the Contractor's expense.

D. Substitutions after the Award of Contract are not allowed.

11. SUBSURFACE AND LATENT CONDITIONS FOUND DIFFERENT

A. Should the Contractor encounter subsurface or latent conditions at the site materially differing from those indicated in the Contract Documents, he shall immediately stop work in the area where differing conditions are found and give notice to the Project Architect/Engineer, Owner, and Office of Facilities and Property Management, of such conditions before they are further disturbed. The Project Architect/Engineer will thereupon promptly investigate the conditions, and if he finds that they materially differ from those indicated in the Contract Documents, he will at once make such changes as he may find necessary, any increase or decrease of cost resulting from such changes to be adjusted in the manner provided in Article 12 - Changes in Work, of the General Conditions.

12. CHANGES IN WORK

A. No changes in the work covered by the Contract Documents shall be made without having such change executed in writing by Contract Change Order and approved by the Project Architect/Engineer, Owner, Director of Office of Facilities and Property Management and the Director of Accounts and Reports. Any change in the work performed by the Contractor without signed approval shall be done at the Contractor's expense.

B. In cases of emergency, or as needed to expedite the work in a timely manner, the Project Architect/Engineer may authorize, in writing, changes in, or additions to, Work to be performed or material to be furnished pursuant to the provisions of the Contract. These field orders shall be incorporated into formal Contract Change Orders at a later date.

C. Changes in the work covered by Contract Change Order include, but are not limited to: extension or reduction in project completion time, charges or credits resulting from changes in construction. A Change Order is the sole remedy for the contractor. No request may reserve the right to additional compensation or remedies related to work in the request regardless of any language to the contrary. Charges or credits to the contract sum for work covered by the approved change order shall be determined by one or more, or a combination of the following methods:

1. By an acceptable unit price or lump sum proposal from the Contractor and the Subcontractors of any tier. Proposal shall include all take-off sheets of each Contractor and Subcontractor of any tier. Breakdowns shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor cost per hour shall identify the base labor rate and applicable fringe benefits plus associated expenses for social security, worker’s compensation, and federal and state unemployment.

2. By a cost-plus-fixed-fee (percentage) basis with maximum price, total cost not to exceed maximum specified.

3. By unit prices contained in the Contractor’s original proposal and incorporated in the Construction Contract. Unit prices contained in the Contractor’s original proposal are understood to include the Contractor’s overhead and profit. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order that application of such unit prices to quantities of the Work proposed will cause substantial inequity to the Owner or to the Contractor, the applicable unit prices shall be equitably adjusted.

D. Overhead and profit on Change Orders shall be applied as follows:

1. The overhead and profit charged by the Contractor shall be considered to include, but not limited to, performance bond, builder’s risk and public liability insurance, job site office expense, incidental job supervision, field supervision, company benefits, general office overhead, and cost associated with the

preparation of design documents, layout drawings, or shop drawings. The percentages for overhead and profit charged on Change Orders shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved but in no case shall exceed the following:

OVERHEAD AND PROFIT FOR ADD CHANGE ORDERS

	Overhead	Profit	Fee
To Contractor on work performed by other than his own forces:	0%	0%	10%
To First level subcontractor on work performed by his subcontractors:	0%	0%	10%
To Contractor and/or his sub-contractors for that portion of work performed with their respective forces:	10%	10%	0%

2. On proposals covering both increases and decreases in the amount of the Contract, the application of overhead and profit shall be on the net change of the direct cost for the Contractor or Subcontractor of any tier performing the Work.

3. The percentages for overhead and profit credit to the Owner on Change Orders that are strictly decreases in the Quantity of work or material shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved.

E. No claim for an addition to the Contract sum will be valid unless authorized as aforesaid in writing by the Project Architect/Engineer. In the event that none of the foregoing methods are agreed upon, the Project Architect/Engineer may require the contractor to complete the work by force account. The cost of such Work will be determined by the Contractor's actual labor and material cost to perform the work plus applicable overhead and profit as outlined above recorded on a daily basis. The Owner's Representative and the Project Architect/Engineer will verify daily the Contractor's time and material for the Work.

F. Any work completed by the Contractor outside the original project scope without written approval from the Project Architect/Engineer will be deemed as a waiver by the Contractor for additional compensation for said work.

G. The Owner will either accept or reject a change order within (14) calendar days after receipt of complete change order pricing and documentation from the Contractor as outlined in this Article.

13. SEPARATE CONTRACTS

A. When separate Contracts are awarded for different portions of the Project or other work at the site, the term Contractor in the Contract Documents in each case shall mean the contractor who executes each separate Contract with the Owner. The term Prime Contractor shall mean that specific contractor established by the Contract to serve as coordinator and director of all work, and all contractors placed under the contractual authority of the prime contractor shall provide work for the project in accordance with the direction of the prime contractor. Failure to abide by this provision shall constitute a breach of Contract.

B. The Owner reserves the right to perform work related to the project with his own forces, and to award separate contracts in connection with other portions of the Project or other work on the site under these or similar conditions of the Contract. All contractors shall fully cooperate with each other and carefully fit the work to that provided under other contracts as may be directed by the Owner. It shall be the duty of each Contractor to whom Work may be awarded, as well as all Subcontractors of any tier employed by them, to communicate immediately with each other in order to schedule Work, locate storage facilities, etc., in a manner that will permit all Contractors to work in harmony in order that Work may be completed in the manner and within the time specified in the Contract Documents.

C. No Contractor shall delay another Contractor by neglecting to perform his work in the proper sequence. Each Contractor shall be required to coordinate his work with other Contractors so as to afford others reasonable opportunity for execution of their work. Any costs caused by defective or ill-timed work, including actual damages, if applicable, shall be borne by the Contractor responsible therefore.

D. The Contractor shall not claim from the Owner money damages or extra compensation under this Contract when delayed in initiating or completing his performance hereunder, when the delay is caused by labor disputes, acts of God, or the failure of any other Contractor to complete his performance under any Contract with the Owner, where any such cause is beyond the Owner's reasonable control.

E. Progress schedule of the Contractor for the Work shall be submitted to other Contractors as necessary to permit coordinating their progress schedules.

14. SUBCONTRACTS

A. The Contractor may utilize the services of specialty subcontractors on those parts of the Work, under normal contracting practices, as performed by such subcontractors.

B. Unless otherwise required by these Contract Documents or the Bidding Documents, the Contractor, within ten (10) days after the award of the Contract, shall furnish to the Project Architect/Engineer and the Director of Office of Facilities and Property Management in writing the names of the persons or entities proposed for each of the principal subcontracted portions of the work. The Contractor shall not award any work to any subcontractor found unqualified by the Project Architect/Engineer, Office of Facilities and Property Management, or the Owner.

C. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

D. Nothing contained in Contract Documents shall create any contractual relation between any subcontractor and the Owner.

E. The Contractor, by written agreement, shall require each subcontractor, to the extent of the work to be performed by the subcontractor, to be bound to the Contractor by the terms of these Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these documents, assumes toward the Owner and the Project Architect/Engineer. Said agreement shall preserve and protect the rights of the Owner under the Contract Documents. Where appropriate, the Contractor shall require each subcontractor to enter into similar agreements with his sub-subcontractors.

15. MUTUAL RESPONSIBILITY OF CONTRACTORS

A. If, through acts of neglect on the part of the Contractor, any other contractor or any subcontractor shall suffer loss or damage on the work, the Contractor agrees to promptly settle with such other contractor or subcontractor by agreement or otherwise to resolve the dispute. If such other contractor or subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and hold harmless the Owner against any such claim.

16. PROJECT ARCHITECT/ENGINEER'S AUTHORITY

A. The Project Architect/Engineer shall determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are provided under this Contract and shall decide all questions which may arise in relation to said Work and the construction thereof. In case any question shall arise between the parties hereto relative to said Contract or Specifications, the determination or decision of the Project Architect/Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this Contract affected in any manner or to any extent by such question.

B. The Project Architect/Engineer shall decide the meaning and intent of any portion of the Contract Documents where the same may be found obscure or be in dispute. Any differences or conflicts in regard to their work which may arise between the Contractor under this Contract and other contractors performing work on this Project for the Owner shall be adjusted and determined by the Project Architect/Engineer.

C. The Project Architect/Engineer shall provide responsible Construction Administration. After consultation with the Owner and Office of Facilities and Property Management he has authority to stop the Work whenever such stoppage may be necessary to insure proper execution of the Contract.

D. The Project Architect/Engineer is the interpreter of the conditions of the Contract and the judge of its performance; as such, he shall side neither with the Owner nor with the Contractor, but shall use his powers under the Contract to enforce its faithful performance by both.

E. He shall, within a reasonable time, act on submittals and make decisions on all matters relating to the progress of the Work or the interpretation of the Contract Documents.

F. The Project Architect/Engineer's decisions are subject to review by the Director of the Office of Facilities and Property Management.

1. All claims must be brought to the attention of the Director within ten (10) days of the Project Architect/Engineer's decision which is being reviewed. The Director or his designee shall meet with the Contractor and Project Architect/Engineer to hear the positions of both parties. The director may designate alternative procedures to receive and review the positions of the parties. If a negotiation committee was assembled to select the Project Architect/Engineer, the director may delegate the decision making power to those individuals. The director, his designee or the negotiating committee shall render a decision within thirty (30) days of the hearing.

17. DUTIES OF THE CONTRACTOR

A. The Contractor shall provide and pay for all materials, labor, tools, equipment, transportation, and superintendence, and coordination of subcontractors necessary to execute, complete, and deliver the work within the specified time. Whenever the Contract Documents indicate work to be performed by the Contractor, it shall mean at the Contractor's expense.

B. Properly prepare all Work to receive subsequent Work or finish. Notify the Project Architect/Engineer if any Work is unsatisfactory to receive such subsequent Work or finish and receive his instructions before proceeding.

C. The Contractor shall supply sufficient and competent supervision and personnel, and sufficient material, plant, and equipment to prosecute the Work with diligence to insure completion thereof within the time specified in the Contract Documents, and shall pay when due any laborer, Subcontractor of any tier, or supplier.

D. The Contractor, if an individual, shall give the Work an adequate amount of personal supervision, and if a partnership or corporation or joint venture the Work shall be given an adequate amount of personal supervision by a partner or executive officer, as determined by the Owner's Representative.

E. The Project Architect/Engineer, Office of Facilities and Property Management, and the Owner's Representative shall, at all times, have access to the Work; and Contractors shall provide proper facilities for such access.

F. The Contractor and each of his Subcontractors of any tier shall submit to the Owner such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as the Owner may request concerning work performed or to be performed under the Contract.

G. The Contractor shall be represented at the site by a competent superintendent or foreman from the beginning of the Work until its final acceptance, unless otherwise permitted by the Owner's Representative. The superintendent or foreman for the Contractor for the general building Work shall exercise general supervision over all Subcontractors of any tier engaged on the Work with decision making authority of the Contractor. It is understood that such representative shall be acceptable to the Project Architect/Engineer, Owner, and the Office of Facilities and Property Management, and shall not be replaced without written permission before the project is completed unless he ceases to be on the Contractor's payroll. The superintendent shall be replaced upon request of the Owner.

H. The Contractor shall attend preconstruction conference with all of his appropriate subcontractors.

I. The Contractor shall attend all project meetings with all of his appropriate subcontractors.

J. The superintendent or foreman shall establish and maintain a permanent benchmark to which access may be had during the progress of the Work, shall give all lines and levels, and shall be responsible for the correctness of such. The contractor shall retain the services of a registered land surveyor for the project construction staking and layout if referenced in the Supplemental General Conditions.

K. No pleas as to act, orders or supervision of the Architect, the Owner, or any other person shall be admitted in justification of any errors in construction or departure from terms of the Contract, except for duly executed change orders, additional instructions or additional supplemental contracts, in writing, signed by the Owner.

L. The Contractor shall be responsible for layout of his own work and for any damage which may occur to work of any other Contractor or subcontractors of any tier, because of errors or inaccuracies on the part of this Contractor and his Subcontractor of any tier as well as be responsible for unloading, uncrating, and handling of all materials and equipment to be erected or placed by him, whether furnished by the Contractor or others. The Contractor is further responsible that the layout of work by Subcontractors of any tier which shall be coordinated with layouts of all general construction Work and all other subcontract work. Unless otherwise directed by the Owner's Representative, salvage materials, waste, and scrap resulting from such work shall be promptly removed from the site by the Contractor, at his expense.

M. The Contractor shall limit operations and storage of materials to the area within the project limit lines shown on drawings, except as necessary to connect to existing utilities, shall not encroach on neighboring property, and shall exercise caution to prevent damage to existing structures.

N. The contractor shall follow procedures outlined below for all utility outages/tie-ins:

1. All shutting of valves, switches, etc. shall be in conjunction with or by the Owner's personnel.

2. The Contractor shall request an outage/tie-in meeting at least two weeks before the outage/tie-in is required.

3. The Owner's Representative will schedule an outage/tie-in meeting at least one week prior to the outage/tie-in.

4. The following individuals shall attend this meeting:

   (a) Owner's Representative

   (b) Contractor's Superintendent

   (c) Subcontractors of any tier performing the Work

5. The Contractor shall be prepared to discuss the following at this meeting:

   (a) Date and time of proposed outage/tie-in.

   (b) Detailed work plan to be followed during the outage and the total time required to complete all work.

   (c) Work force to be employed during the outage.

   (d) Owner and/or utility responsibilities during the outage.

   (e) Contingency plan in case of complications (i.e., the availability of additional personnel and materials) during the outage.

6. The Contractor shall be aware that the outage/tie-in time and date is subject to approval by the Owner's Representative.

O. The Contractor shall coordinate all Work so there shall be no prolonged interruption of existing equipment and services. Any existing plumbing, heating, ventilation, air conditioning, or electrical disconnection necessary, which affect portions of this construction or building or any other building, must be scheduled with the Owner's Representative to avoid any disruption of operation within the building under construction or other buildings or utilities. In no case shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities, either intentionally or accidentally, shall not relieve the Contractor from repairing and restoring the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

P. The Contractor shall promptly remedy damage and loss to property referred to in this Article caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this Article.

Q. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials installed, or to be installed by him.

R. The Contractor shall be responsible for care of his finished Work and must protect same from damage or defacement until acceptance by Owner. All damaged or defaced work shall be repaired or replace to the Owner's satisfaction, without cost to the Owner.

S. The Contractor shall comply with all applicable ordinances and regulations. The Contractor shall save the Owner and the Project Architect/Engineer harmless as a result of any failure to do so.

T. Required Code inspections necessary for Occupancy

It is the responsibility of the Contractor to coordinate with the OFPM inspectors to schedule required code inspections. The agency and the project architect/engineer are to be informed of all scheduled required code inspections.

Code inspections (if component is included in the project) are required to be performed by OFPM prior to covering work. These inspections include but are not limited to:

1. Footings and Foundations
2. Underfloor/Under slab
3. MEP Underground (not associated with underfloor/under slab)
4. Framing
5. In-Wall
6. Fire-resistive assemblies and fire-resistant penetrations
7. Above Ceiling
8. Fire Alarm
9. Sprinkler and Standpipe
10. Emergency Lighting
11. Back-up Power Sources
12. Fire Pump
13. Elevator
14. Roof inspections (including tear-off, insulation, membrane placement, flashing)
15. Emergency Power
16. Smoke Control Systems
17. Pressure testing of all piping
18. Locking systems
19. Final Inspections (including exit path and ADAAG verification)

(This information is also outlined on the Occupancy Checklist form located on our website at https://admin.ks.gov/offices/facilities-property-management/design-construction--compliance).

The required code inspections shall be coordinated with OFPM inspector via individual cell telephones. Telephone contact is to be a minimum of 3 work days prior to anticipated inspection. Inspection confirmation may occur via e-mail after telephone coordination. Failure to coordinate a scheduled inspection with a minimum of 3 work days may result in no inspection and subsequent denial of a Certificate of Occupancy.

An **Inspection Record** will be issued by OFPM inspectors for each required inspection. The Inspection Record will indicate when the inspection is approved. If a deficiency is noted, it will be the responsibility of the contractor to coordinate solution of the deficiency with the Project Architect/Engineer and to correct all noted deficiencies as directed by the Project Architect/Engineer. Issuance of the Certificate of (Partial) Occupancy is dependent on resolution of all deficiencies.

(Please note: The inspector, noted in Item 1 above, is to be notified of each required inspection. The inspector, at his discretion, may defer this inspection. The inspector will inform the contractor and agency representative regarding who will be performing the inspection.)

U. When requested by the Project Architect/Engineer, Construction Representative, and the Owner's Representative, the Contractor, at no extra charge, shall provide a safe means for examination of work in progress or completed.

V. No project signs shall be erected without the approval of the Owner's Representative.

W. The Contractor shall verify all measurements. No extra charges or compensation will be allowed as a result of the failure to verify dimensions before ordering materials or fabricating items.

X. The Contractor shall provide, at the proper time, such material as required for support of the Work. If openings or chases are required, whether shown on drawings or not, the Contractor shall see they are properly constructed. If required openings or chases are omitted by the Contractor, the Contractor shall provide them at the Contractors own expense, but only as directed by the Project Architect/Engineer.

Y. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists, and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and to make the place of work safe and free from avoidable danger, and as may be required by safety provisions of applicable laws, ordinances, rules, regulations, and building and construction codes.

Z. The Contractor shall be responsible for removal of all rubbish, debris, and dirt resulting from the Work and shall clean up as requested by the Project Architect/Engineer, Construction Representative, and the Owner's Representative. The Contractor shall be responsible for the cost of clean-up and removal from premises. All debris resulting from said removal shall be disposed of off State owned property at an authorized dump site. The building and premises shall be kept clean, safe, in a workmanlike manner, and in compliance with OSHA standards at all times. At completion of Work, all dirt, stains, and smudges shall be removed from every part of the building, all glass in doors and windows shall be washed, and entire Work shall be left broom clean in a finished state ready for occupancy. The Contractor shall advise his Subcontractors of any tier of this provision, and the Contractor shall be fully responsible for leaving the premises in a finished state ready for use to the satisfaction of the Owner's Representative. In detention facility projects, the contractor shall return all security related shop drawings to the Owner.

AA. The Contractor shall accurately record on blue line prints all changes to the original plans made during the installation of the work. The Contractor shall also record all changes to the original specifications made during the installation of the work. The Contractor shall maintain an updated set of Record Documents (both drawings and specifications) at the job site throughout construction (if there is an on-site office). This set of Record Documents shall include all addenda, change orders, field revisions, changes, and alterations that occur during construction and shall be furnished, in good condition, to the Project Architect/Engineer prior to completion of the project.

BB. The Contractor shall establish and be responsible for wall and partition locations. Other Contractors and Subcontractors of any tier shall observe these locations and be responsible for setting their sleeves, openings, or chases.

CC. The Contractor for construction work shall pump, bail, or otherwise keep general excavations free of water. Subcontractors of any tier shall keep their individual excavations free of water in an approved manner. The Contractor shall keep all areas free of water before, during, and after concrete placement.

DD. The Contractor shall be responsible for cutting, fitting or patching required to complete the work or to make its parts fit together properly.

EE. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching, or otherwise altering such construction or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and such separate contractor, such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or separate contractor the Contractor's consent to cutting or otherwise altering the Work.

FF. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the Contract Documents, and shall complete the entire Work to the extent of quality and workmanship implied by the Contract Documents and in a manner which will warrant acceptance by the Project Architect/Engineer, the Owner, and the Office of Facilities and Property Management.

GG. Contractors and Subcontractors employed upon Work shall be required to conform to labor and employment laws of the State of Kansas and various acts amendatory and supplementary thereto and to other laws, ordinances and legal requirements applicable thereto.

HH. The Contractor shall be responsible for the conduct of Contractor's employees and the employees of subcontractors and suppliers on the work site. The Contractor shall take immediate steps to remedy any

activity which may be construed as discriminatory or which creates a hostile work environment. Activities covered by this provision include, but shall not be limited to, signs or language that are vulgar, profane or racially or sexually derogatory.

II. The contractor shall inspect the building and complete deficiencies before the Project Architect/Engineer's final inspection in order to avoid long and multiple punch lists. The building shall be cleaned before the final inspection to allow all defects to be noticed at the final inspection and reduce late additions to the punch list.

18. PROTECTION OF WORK AND PROPERTY

A. In the event of temporary suspension of work, or during inclement weather, or whenever the Project Architect/Engineer shall direct, the Contractor shall, and shall cause his subcontractors to carefully protect his and their work and materials against damage from the weather. If, in the opinion of the Project Architect/Engineer, any work or materials that have been damaged by reason of failure on the part of the Contractor or any of his subcontractors to protect the work, such materials shall be removed and replaced at the expense of the Contractor.

B. The Contractor shall at all times safely guard the Owner's property from damage or loss in connection with his Contract. He shall at all times safely guard and protect his own work, and that of adjacent property, from damage. The Contractor shall replace or make good any such damage or loss unless such be caused directly by errors contained in the Contract Documents, or by the Owner, or his duly authorized representative.

C. In case of an emergency which threatens loss or damage of property, or safety of life, the Contractor will be allowed to act, without previous instructions from the Project Architect/Engineer, in a diligent manner. He shall notify the Project Architect/Engineer promptly thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Project Architect/Engineer for approval as provided for in Article 12 - Changes in Work, herein.

D. The Contractor shall be responsible for and shall pay for all damage to building, walks, pavement, steps, plantings, lawns and any other property which is caused by construction activity. Any such damage shall be corrected by repair or replacement as directed by the Project Architect/Engineer and in a manner acceptable to the Owner.

E. Transport, handle, store and erect materials in a manner to keep them free from damage.

F. Support no runways, ramps or construction equipment on or transport over any items or assemblies subject to displacement, disfigurement or other damage.

G. Protect Work in place which requires job-finishing until said finishing has been completed.

H. Protect previously placed Work with suitable coverings or other protections during installation of subsequent Work. Remove any foreign materials from surfaces, and then clean same immediately with materials that will not damage finished Work (brick, aluminum, etc.) to the satisfaction of the Project Architect/Engineer.

19. RECEIVING AND STORING MATERIALS AND EQUIPMENT

A. Upon receipt of materials and equipment at the job site or another authorized point of delivery, Contractor shall have an authorized person present to check all items for in-transit damage and to make arrangements to replace any damaged materials or equipment in ample time to prevent delay to its scheduled installation.

B. At the point of receipt of materials and equipment, the Contractor shall have sufficient experienced personnel present to unload all items and prepare and locate them for proper storage prior to their installation.

C. Wherever possible, deliver materials and equipment in manufacturers' original crates, boxes or packages, keeping identifying labels intact until installation and final acceptance and cleaning. Where items are to be job-assembled, label, tag, mark or otherwise properly identify each component part until incorporated in the Work.

D. Provide waterproof, well-ventilated enclosures for storage of materials and equipment subject to damage by dampness, frost, freezing, etc. Location for said enclosures shall be where approved by the Owner.

E. Storage of materials and equipment outside on pallets with any type of covering material over them will not be allowed, unless permission to do so has been documented in writing by the Architect or Engineer.

F. Remove from the premises and replace with new, any materials and equipment determined, in writing, by the Project Architect/Engineer to be in any condition not acceptable for use on the Project.

20. SAFETY

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

B. Precaution shall be exercised at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws and building and construction codes shall be observed. Machinery, equipment and hazardous conditions shall be guarded, including warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities or eliminated in accordance with the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; and Occupational Safety and Health Standards, published by Occupational Safety and Health Administration, U.S. Department of Labor; or their successor publications., latest and best edition, amendments or addenda.

C. All contractors/suppliers hereby agree to comply with all applicable occupational safety, health and environmental laws, regulations, standards, codes and/or ordinances at all times from inception through completion of this Contract. This includes, but is not limited to, the Hazard Communication Standard under the Occupational Safety and Health Act (for information and free assistance, contact the Kansas Department of Labor, Division of Industrial Safety and Health, 512 S.W. 6th Street, Topeka, Kansas 66603-3150, telephone 913-296-4386); and the Emergency Planning and Community Right-to-Know Act (for information and free assistance, contact the Kansas Department of Health and Environment Right-to-Know Program, 109 S.W. 9th Street, Suite 501, Topeka, Kansas 66612-1290, telephone (785-296-1690).

D. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of authorities having jurisdiction bearing on safety of persons or property or their protection from damage, injury, or loss.

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

F. The Contractor shall be responsible for the safety of all persons while on the construction site. The Contractor shall maintain construction area safety which may include providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences, and other devices appropriately located on site which shall give proper and understandable warning to all persons of danger, entry onto land, structure, or equipment as required by code and all other regulatory requirements.

G. If the Contractor encounters on the site, material believed to be hazardous which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Architect and the Owner's Representative in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Architect and Contractor if in fact the material is hazardous and has not been rendered harmless. Hazardous materials are those as defined by Kansas Department of Health and Environment's response list.

H. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover any such hazardous conditions and shall be solely responsible for correction of any such conditions.

I. It shall be the sole responsibility of the Contractor to enforce or direct safety rules or procedures. It shall not be the responsibility of the Owner or Project Architect/Engineer to enforce or direct safety rules or procedure.

J. Contractor shall hold harmless and indemnify the Owner and Project Architect/Engineer from damages and expenses from any and all claims related to this Article for bodily injury or property damage or expenses incurred by any person or firm.

K. The Contractor shall properly execute the work before proceeding to the next step in sequence so as not to endanger the safety of all persons while on the construction site.

21. CORRECTION OF THE WORK

A. The Contractor shall promptly correct Work rejected by the Project Architect/Engineer for failing to conform to the requirements of the Contract Documents, whether observed before or after final completion. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for the Project Architect/Engineer's services and expenses made necessary thereby.

B. The Contractor shall remove from the site, at his expense portions of the Work which are not in accordance with the requirements of the Contract Documents and not accepted by the Project Architect/Engineer.

C. If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents or fails to perform any provision of the Contract, the Owner may, after ten (10) days written notice from the Project Architect/Engineer to the Contractor and without prejudice to any other remedy he may have, make good such deficiencies. In such case, an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including the cost of the Project Architect/Engineer's additional services made necessary by such default, neglect or failure. Such Change Order **shall not** require the approval of the Contractor.

D. The Contractor and his surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as the result of the actions set forth in this Article.

E. If the Project Architect/Engineer accepts Work which is not in accordance with the Contract Documents, he may do so instead of requiring its removal and correction, in which case the Contract Sum will be adjusted as appropriate and equitable. Such adjustment shall be made whether or not final payment has been made.

22. CONSTRUCTION SCHEDULE AND REPORTS

A. At the Pre-construction conference, the Contractor shall present to the Project Architect/Engineer a construction schedule and a Schedule of Values. The Contractor (or designated prime contractor) shall coordinate each contractor's or subcontractor's schedule and establish a mutually acceptable schedule for the entire progress of the Work and shall deliver the schedule to the Project Architect/Engineer in a form satisfactory to the Office of Facilities and Property Management and the Owner. Schedule shall be coordinated with and approved by the Project Architect/Engineer, the Owner, and Office of Facilities and Property Management.

B. Include in the construction schedule the number of allowed adverse weather days as noted in Document E, Article 50 of this manual.

C. The construction progress schedule shall include as a minimum the following detail:

1. The proposed schedule for tasks identified in the Schedule of Values in bar chart form.

2. Important milestones which may impact the construction progress schedule shall be identified by a critical path schedule using either bar chart or the Critical Path Method. Projects with construction costs below $250,000 shall require a bar chart schedule. Projects with construction costs above $250,000 shall require both a bar chart schedule and a Critical Path Method schedule.

3. Anticipated monthly payments for the duration of the project by the Owner based on the rate of progress proposed by the Contractor upon request.

4. Submission dates of all details and shop drawings.

5. Procurement and delivery dates for all equipment and material.

6. Weekly breakdown of work and activities for each major component of work. Define special items as directed by the Project Architect/Engineer.

7. Intended time for starting and completing each activity including indication of float time.

D. There will be no payment of any periodic estimate until the Contractor's list of Material Suppliers, Construction Progress Schedule, and Schedule of Values have been approved by the Project Architect/Engineer.

E. The construction progress schedule shall be maintained current at all times by the Contractor (or the designated prime contractor). Revisions shall be made in the same detail as the original and shall be accompanied by written explanation of the reasons for the revision and shall be subject to the approval of the Project Architect/Engineer. Copies of the revised construction progress schedule shall be delivered to the Project Architect/Engineer, Owner, and the Office of Facilities and Property Management monthly during the course of the Work.

F. The Contractor (or designated prime contractor) shall submit monthly to the Project Architect/Engineer progress reports showing actual percentage of each activity completed, estimated future progress and anticipated completion time of such activity.

G. Should the Contractor fail to meet completion dates required by the progress schedule, the Owner's representative may issue a written notice to the Contractor requiring the Contractor to submit a written plan for expediting the Work to comply with the progress schedule. The plan shall be submitted to the owner's representative within ten (10) days after the Contractor's receipt of such notice. The Contractor's plan shall specify the dates and means by which the Contractor will bring the work back on schedule. Means may include, but are not limited to, hiring additional workers, working additional hours, utilizing additional equipment, or expediting delivery of materials. If the Contractor fails to submit a written plan or fails to comply with dates specified in the plan for bringing the Work back on schedule, the owner's representative may, by written notice, require that additional workers, plant and equipment be placed on the Work or require that hours, in addition to regular hours, be worked until progress is as scheduled, with no additional cost to the Owner. The Contractor shall immediately implement requirements of the notice.

23. TIME FOR COMPLETION

A. Time limits stated in the Contract Documents are of the essence of the Contract. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the Work, described in the Contract is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industry conditions prevailing in this locality. Unless otherwise provided in the Contract, the time for completion is measured by calendar days, not work days.

B. If the Contractor’s schedule provides for an earlier completion date than the established contract completion date, and the agency desires to change the contract completion date to the earlier date, this may be done through a change order to the contract. This change order does not require the approval of the Contractor.

C. Except in cases of emergency or by agreement or instruction of the Project Architect/Engineer in writing, the Contractor shall not knowingly, prematurely commence operations on the site or elsewhere prior to the effective date of insurance as required to be furnished by the Contractor, and by the effective date of the Notice to Proceed.

D. The Contractor shall proceed expeditiously with adequate forces and shall achieve Final Completion within the time specified on Contract Documents. A delay in the delivery to the site of any materials or equipment will not be considered as a valid reason for a time extension to the Contract.

E. At the end of the time for completion, all equipment and systems shall be fully operational and functioning as required by the specifications. Testing shall be completed and all defects discovered as a result of this testing shall be corrected before the completion date.

F. It is further agreed that time is of the essence of each and every portion of this Contract wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. These are not compensable delays. Time extensions, only if they impact the progress of the Work in a negative manner, may be granted if the delay is due:

1. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not limited to, acts of God, or of the public enemy, fires, floods, epidemics, quarantine restrictions, strikes or embargoes. For weather delays, see (G) below.

2. To any delays of subcontractors or suppliers occasioned by any of the causes specified in subsection 1) of this article.

3. The Contractor shall, within ten (10) days from the beginning of such delay, notify the Project Architect/Engineer, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of his decision in the matter.

G. Claims for delay due to “unusually severe weather” affecting the completion time shall only be considered when meeting the following criteria:

1. Definitions:

(a) “Adverse weather” – weather conditions during a definite time and place that are unfavorable to construction activities.

(b) “Unusually severe weather” – weather that is more severe than the “adverse weather” anticipated for the season at the location of the construction project.

2. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather to be anticipated for the project location during any given month.

3. The delay must be related to the unusually severe weather and not due to the Contractor’s fault, negligence, or his failure to maintain the approved construction schedule.

4. The unusually severe weather must cause actual delay to the completion time of the project. A claim for unusually severe weather delay must document actual delay to a scheduled critical path construction activity for at least 50% or more of the Contractor’s scheduled workday. On projects without critical path scheduling, the Owner may withhold final determination of the delay claim until the Contractor submits an updated construction schedule for approval.

5. Anticipated “adverse weather” days. The Contract includes and anticipates that adverse weather conditions, including rain, snow, wind and extreme temperatures, will occur during the period of the Contract and will delay the Work. The schedule of monthly anticipated “adverse weather” delay days shall be incorporated in the “Time of Completion” for the project.

6. To meet the criteria for an unusually adverse weather delay day, one of more or the following requirements must be met within the work day and cause and delay a scheduled critical path construction activity, as noted in G4 above.

(a) Rainfall equal to or greater than 0.10 inches.

(b) Average temperatures less than 20 degrees Fahrenheit.

(c) Snowfall in excess of 1.0 inches.

(d) Sustained wind speed in excess of 25 mph.

7. Evaluation of a claim for delay caused by unusually severe weather shall be as follows:

(a) Claims for delay shall be submitted no later than ten (10) days after the end of the month to be evaluated.

(b) The Contractor shall submit documentation indicating cause, affect and delay including the weather criteria on each adverse weather delay day that occurred during the month to be evaluated. Any day that is submitted that does not meet the criteria shall be deemed not to qualify as an adverse weather delay day.

(c) Documentation of adverse weather criteria shall be submitted in their original form from a recognized weather recording station, newspaper, computer information service, or other Owner approved source. In the event there is no weather recording source at or near the project location, the contractor shall record the daily weather information in a format meeting the criteria in G6 above. The weather documentation source will be determined at the pre-construction meeting.

(d) In order to calculate the delay from the supplied tables, deduct the number of anticipated adverse weather delay days listed for the month being evaluated.

(e) If the monthly total of qualifying adverse weather delay days exceeds the number of anticipated adverse weather delay days, the net difference in qualifying delay days will constitute unusually severe weather. The number of qualifying delay days will be added to the Contract as an adjustment to the "Time of Completion". There shall be no change in the Contract amount for this type of claim.

H. Acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, that will cause delay to this Contractor, shall be brought to the attention of the Project Architect/Engineer in writing within ten (10) calendar days. Failure to notify the Project Architect/Engineer immediately will cause the Contractor to waive his right to extra days or damages therefrom.

I. Permitting the Work or any part of it to continue after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the Owner of any of his rights under the Contract.

J. Liquidated damages are prescribed in Document E, Article 49 - Liquidated Damages, and are hereby agreed to by all parties.

K. The Contractor, and any of its subcontractors, suppliers, material men or any other such party, shall have no claim for monetary compensation, monetary claims, or damages, of whatever kind or nature, for delay, hindrance, or inefficiency. The Contractor's only claim and the Contractor's only remedy for such delay, hindrance or inefficiency shall be for an extension of time as provided in Article 23 unless the claim is the result of (a) a negligent act, error or omission of the Project Architect/Engineer; (b) an unforeseeable site condition materially differing from that shown in the construction documents; or, (c) a negligent act or omission or breach of contract by the Owner. In these cases the Contractor shall receive compensation as provided in Article 12 - Changes in the Work.

L. At such time as the Contractor believes the project to be substantially complete, the Contractor shall notify the Project Architect/Engineer and request an inspection. The Project Architect/Engineer shall conduct an inspection and prepare a list of all items that have not been completed (if the Project Architect/Engineer determines that the construction is not complete and ready for the inspection, he shall so inform the Contractor). The Contractor shall complete all the items listed by the Project Architect/Engineer before the adjusted completion date in the contract (contract completion date with change orders adjustments). Upon completion of all such items, the Contractor shall request a final inspection which shall be conducted by the Project Architect/Engineer.

M. If the Project Architect/Engineer determines that any of the items listed have not been completed by the adjusted completion date of the contract, the Contractor shall be responsible for the cost of the additional Project Architect/Engineer's services beyond the adjusted completion date of the contract. The Contractor shall not be responsible for the cost of any additional inspections if the failure to complete listed items is caused by the Project Architect/Engineer or Owner. Such costs shall be covered by a change order and shall be paid to the Project Architect/Engineer. Such change order shall not require the approval of the Contractor.

24. RIGHT OF OWNER TO SUSPEND CONTRACT

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

B. An adjustment will be made for increases in the cost of performance of the Contract caused by suspension, delay or interruption. No adjustment will be made to the extent:

1. that performance is, was, or would have been so suspended, delayed or interrupted by another cause for which the Contractor in whole or in part is responsible, or

2. that an equitable adjustment is made or denied under another provision of this Contract.

C. Should the Owner be prevented or enjoined from proceeding with the work either before or after the start of construction by reason of any litigation, act of God, or other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of work will be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay; such determination to be set forth in writing. The Contractor will not be required to hold his bid price for longer than three months. The Owner may either negotiate a Change Order with the

Contractor for any additional costs, or terminate the Contract following the three-month period. Should the Contract be terminated, the Contractor will be compensated for all work performed to date on the Contract.

25. RIGHT OF OWNER TO TERMINATE CONTRACT - CAUSE AND CONVENIENCE

A. In the event that any of the provisions of this Contract are violated by the Contractor, or by any of his subcontractors, the Director of the Office of Facilities and Property Management, on behalf of the Secretary of Administration, may serve written notice upon the Contractor and the surety of their intention to terminate the Contract for cause. Such notice shall contain the reasons for such intention, and unless within ten (10) days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement or correction be made the Contract shall upon expiration of said ten (10) days, cease and terminate.

B. In the event of any such termination for cause the Director of the Office of Facilities and Property Management shall immediately serve notice thereof upon the surety and the Contractor, and the surety shall have the right to take over and perform the Contract, provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such surety of notice of termination, the Owner may take over the Work and prosecute the same to completion by Contract at the expense of the Contractor, and the Contractor and his surety shall be liable to the Owner for any excess cost above the original Contract amount occasioned the Owner thereby. In such event, the Owner may take possession of and utilize in completing the Work, such materials, appliances and plant as may be on the site of the Work and necessary therefore.

C. The Director of the Office of Facilities and Property Management, on behalf of the Secretary of Administration may, at any time, terminate the contract for convenience and without cause. Upon service of written notice the contractor shall:

1. cease operations as directed by the Director in the notice,

2. take actions necessary or as directed in the notice for the protection and preservation of the Work, and

3. except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts or purchase orders.

D. All materials previously paid for by the Owner shall be delivered to or remain on the construction site.

E. In case of termination for convenience the contractor shall be entitled to payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed, not to exceed 10% for each.

26. BONDS

A. A Performance Bond shall be furnished to the Owner by the Contractor in an amount equal to one hundred percent (100%) of the Contract price as security for the faithful performance of this Contract and as security for the payment of all persons performing labor and furnishing materials in connection with this Contract. Bonds are to cover all claims discovered during construction or prior to the end of the warranty period.

B. A Public Works Bond as required by K.S.A. 60-1111 shall be furnished to the Owner by the Contractor in the amount of one hundred percent (100%) of the contract price and shall be filed with the Clerk of the District Court in the county where the Project is being constructed. A Public Works Bond is **not** required for projects with a contract price below $100,000.

C. Bonds shall be issued by a surety company authorized by Kansas law and returned within 15 calendar days.

27. SUBSTITUTE BONDS

A. If at any time the Owner for justifiable cause, shall become dissatisfied with the surety bound by the Performance and Public Works Bond, the Contractor shall within fifteen (15) days after notice from the Owner so do to, substitute an acceptable bond in such form and sum and signed by such other surety as may be satisfactory to the Owner.

B. No further payments shall be deemed due nor shall be made until the new surety shall have furnished such an acceptable bond to the Owner.

C. The credit due on premiums for unused portion of canceled bond shall be applied to premiums on the substitute bond and the difference for remaining premium cost will be paid by the Owner.

28. SALES TAXES

A. If the project is exempt, the Owner will secure a project exemption certificate for the project in accordance with the rules of Kansas Department of Revenue. The Contractor shall refer to the Form of Bid and Supplemental General Conditions to determine the tax exemption status of the project.

B. If the project is tax exempt, the Owner shall obtain a project exemption certificate, and furnish a copy of the same to the Contractor. The Contractor shall furnish a copy of the project exemption certificate to all suppliers from whom purchases are made, and to all subcontractors. Suppliers who supply materials for the project shall execute invoices covering the same bearing the project number from such certificate. Upon completion of the Project, each Contractor, and each Subcontractor who used the project exemption certificate to claim exemption, shall furnish to the Owner a sworn statement, on a form provided by the Director of Taxation, that all its purchases made exempt under the project exemption certificate were entitled to exemption. All invoices shall be held by the Contractor and Subcontractors for a period of five (5) years and shall be subject to audit.

C. If a project is not exempt, the Contractor and each Subcontractor shall pay all sales tax required by law on labor and materials purchased to perform the contract. The Contractor shall include in his bid all such sales tax that is required to be paid on the material and labor needed to perform the contract. The type of project, the status of its owner, and the existence of a project exemption certificate will determine whether the contractor and subcontractor are required to pay sales tax on labor or material or are exempted for paying tax on labor or material or on both.

29. QUANTITIES OF ESTIMATES

A. Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is especially reserved to increase or diminish them as they may be deemed reasonably necessary or desirable to complete the Work contemplated by this Contract, and such increase or diminution shall in no way vitiate this Contract, nor shall any such increase or diminution give cause for claims or liability for damages.

30. PAYMENTS TO CONTRACTOR

A. The Owner will make partial payments to the Contractor for the value, proportionate to the amount of the Contract, of all labor and material incorporated in the work during the preceding calendar month upon receipt of certification from the Project Architect/Engineer and approval of the Owner and the Office of Facilities and Property Management. No payment will be made to the Contractor until Procurement and Contracts has received all documentation required to be submitted by the Contractor.

B. The Contractor shall submit to the Project Architect/Engineer a request for certification for each payment, on current AIA documents G702 and G703. Contractors shall be responsible for securing their own AIA forms. Each item identified on the Schedule of Values shall be broken down into material and labor as separate items on the G703. This request for certification shall be submitted in the number of copies directed, and shall include the Contractor's detailed estimate of all items and activities of work to be performed, in the space provided on the form. If requested, the statement shall be supported by such evidence as may be required, showing the Contractor's right to the payment claimed.

1. Project architect/engineer will review, approve and forward undisputed requests to the Owner within seven (7) days of receipt.

C. Periodic estimates of Work completed shall be correlated with the schedule of values and furnished to the Project Architect/Engineer with requests for partial payment.

D. Request for payment for preparatory work and materials delivered and suitably stored at the site to be incorporated into the work at some future period, will be given due consideration. The Project Architect/Engineer may, under certain circumstances, approve payment up to ninety percent (90%) of the value of manufactured products delivered to a suitable warehouse at or near the locale of the project. Stored products shall be insured to one hundred percent (100%) of their value. Proof of said insurance shall be

given to the Project Architect/Engineer. A bill of sale and their costs, including an itemized inventory of all stored products, shall be obtained and provided the Project Architect/Engineer. Approval of the surety company of the Contractor shall also be obtained and provided to the Project Architect/Engineer before these items are stored. Insurance for stored materials shall include transportation from the warehouse to the job site.

E. Payments by the Owner will be due within thirty (30) days after receipt of certified request for payment from the Project Architect/Engineer.

F. Ten percent (10%) of the Work Completed to Date will be retained on each payment request until final completion and acceptance of all Work covered by the Contract.

1. Upon 50% completion, the Office of Facilities and Property Management, Owner and Project Architect/Engineer **may** reduce retainage to a minimum of 5% of the total project cost upon the following conditions:

(a) Reduction of retainage is not automatic. Any reduction must be requested. Approval may be withheld for a variety of reasons, to include progress not on schedule, concerns about quality of work, etc. Applications for payment that assume a reduction before it is approved will be returned for correction, thus delaying payment.

(b) Retainage of 10% is mandatory if the critical path progress of the work is not on schedule, including previously agreed upon change order days. If retainage had been reduced on previous applications for payment, and work falls behind the critical path schedule, retainage will revert back to the full 10% of the total invoiced cost to date on all applications until the work is back on schedule.

2. Retainage will be released on any undisputed payment within thirty (30) days after Substantial Completion of the project. When a subcontractor continues to work on the project after Substantial Completion, the Owner may withhold that portion of the retainage attributed to the subcontractor until thirty (30) days after the work is completed.

G. All material and work covered by partial payments shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and adequate protection from weather, damage, vandalism, theft, and fire of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the Contract.

H. If overpayment occurs, the Owner has the right to stop payment applications until the actual Work completed is equal to the payment applications and certified by the Project Architect/Engineer to be in compliance with the contract documents.

I. Final payment will be made within thirty (30) days after final completion of the work.

J. Prior to the issuance of final payment, the Contractor shall submit a certification that all debts and claims against this project have either been paid in full or otherwise satisfied in the form of an Affidavit of Contractor.

K. No recourse shall be had against any individual employee or agents of the State of Kansas, or officer thereof, for any payment under the contract or any claim based thereon.

31. PAYMENTS BY CONTRACTOR

A. The Contractor shall pay within seven (7) days of receipt of payment from the Owner, each subcontractor out of the amount paid to the Contractor on account of each subcontractor's work, the amount to which said subcontractor is entitled, reflecting the percentage actually retained, if any, from payments to the Contractor on account of each subcontractor's work. The Contractor shall, by an appropriate agreement with each subcontractor, require each subcontractor to make payments to his sub-subcontractors in similar manner.

32. SUBCONTRACTOR PAYMENT INDEMNIFICATION

A. The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, material suppliers, and furnishers of

machinery and parts thereof, equipment, power tools, and all supplies, incurred in the furtherance of the performance of this Contract.

33. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

A. The making of final payment shall constitute a waiver of all claims by the Owner except those arising from:

1. unsettled liens

2. faulty or defective work appearing after Final Project Completion

3. failure of the Work to comply with the requirements of the Contract Documents, or

4. terms of any special guarantees or warranties required by the Contract Documents.

B. The acceptance of final payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and still unsettled.

34. USE AND OCCUPANCY PRIOR TO ACCEPTANCE

A. If the construction schedule is current, the Contractor agrees to the Owner's use and occupancy of a portion or unit of the Project before the date of final completion, provided:

1. The Owner assumes all costs for maintenance of heat, electricity and water, and provides custodial care and maintenance of the occupied portions.

2. The Owner accepts all work as fully complete within that portion or unit of the Project to be occupied, at time of occupancy.

B. If the Construction schedule is not current, the Contractor agrees to the Owner's use and occupancy of all or a portion of the project:

1. Contractor is responsible for completing scheduled Work as noted on inspection report listing any incomplete work and Work as defined in the Contract Documents.

2. Contractor is responsible for cleaning up dust and debris caused by work completed in the occupied areas.

3. Contractor is responsible for a final clean-up in all areas where occupancy has occurred prior to final completion.

35. GENERAL GUARANTEE

A. The Contractor shall remedy and make good all defective workmanship and materials and pay for any damage to other work or property resulting therefrom, which appear within a period of one year from the date of final project completion, providing such defects are not clearly due to abuse or misuse by Owner. The Owner will give notice of observed defects with reasonable promptness. The one (1) year period will not apply to defective workmanship and materials not discovered within the one year period.

B. Neither the final certificate for payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any expressed warranties or responsibility for faulty materials or workmanship.

C. The guarantee on all work covered under this contract shall begin on the date of Final Project Completion or substantial completion if applicable. If the building is partially occupied, the date of partial occupancy shall establish the beginning date for the guarantee period for that section of the building and for all equipment in place, operable and used for this area. Any additional work in this area shall be considered warranty work by the Contractor.

D. Where guarantees or warranties are required in sections of specifications for periods in excess of one year, such longer terms shall apply.

E. Within nine months after official acceptance of a Project, the Owner, the Contractor, the Project Architect/Engineer and the Office of Facilities and Property Management shall conduct a full inspection of the completed project and the Contractor shall promptly correct all items noted.

F. If, within one year after the date of Final Completion of the Work or designated portion thereof, or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found not to be in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Project Architect/Engineer to do so unless the Project Architect/Engineer has previously given the Contractor a written acceptance of such condition.

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

36. ARBITRATION, DAMAGES AND WARRANTIES

A. Notwithstanding any language to the contrary, no interpretation of this Contract shall be allowed to find the State or any agency thereof has agreed to binding arbitration, the payment of damages or penalties upon the occurrence of a contingency, or to permit disclaimer of any or all warranties.

37. PATENTS AND ROYALTIES

A. The Contractor shall pay all royalty and license fees. The Contractor shall defend suits or claims for infringement of patent or copyright rights and shall hold the Owner, its officers, agents and employees and the Project Architect/Engineer harmless from all loss and expense on account thereof.

B. If the Contractor uses any item covered by a patent or trademark, he shall reach an agreement with the holder of the patent or copyright.

38. INDEMNIFICATION

A. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner and the Project Architect/Engineer and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense 1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and 2) is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this paragraph.

B. In any and all claims against the Owner or the Project Architect/Engineer or any of their agents or employees by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The obligations of the Contractor shall not extend to the liability of the Project Architect/Engineer, his agents or employees, arising out of 1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or 2) the giving of or the failure to give directions or instructions by the Project Architect/Engineer his agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

39. ASSIGNMENTS

A. The Contractor shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder without written consent of the Owner; Office of Facilities and Property Management; Director of

Procurement and Contracts and the Director of Accounts and Reports. In case the Contractor assigns all or any part of any moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

B. Such assignment shall not be made without the consent of the surety unless the surety has waived its right to notice of assignment.

40. REQUIRED PROVISIONS DEEMED INSERTED

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

41. KANSAS ACTS AGAINST DISCRIMINATION

A. The Contractor hereby agrees and covenants as a condition of the Contract that he will comply with the Kansas Act Against Discrimination, (K.S.A. 44-1001 et seq.) and the Kansas Age Discrimination in Employment Act (K.S.A. 44-1111 et seq.) and the Americans With Disabilities Act (42 U.S.C. 12101 et seq.), and that his failure to do so may be deemed to be a breach of Contract and may subject the Contract to be terminated.

42. ANTITRUST

A. For good cause, and as consideration for executing this Contract, the Contractor, acting herein by and through its authorized agent, hereby conveys, sells, assigns and transfers to the State of Kansas all right, title and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of Kansas pursuant to this Contract.

43. OPTIONAL PERFORMANCE AND PAYMENT GUARANTEE

A. The Contractor may elect to use a certificate of deposit as a performance and payment guarantee in lieu of providing a Performance Bond and Public Works Bond. The certificate of deposit shall have a value of not less than the amount of the Contract, and shall serve the purpose of the Performance and Public Works Bonds as defined in Articles 26 and 27 of the General Conditions of the Contract.

B. The Director of Procurement and Contracts may accept a certificate of deposit payable to the State of Kansas, without condition, in lieu of any required surety bond from a bidder or contractor in the case of any contract for construction, repairs or improvements under K.S.A. 75-3739, 75-3741 or 60-1111 and amendments thereto.

C. The certificate of deposit shall be subject to forfeiture to the State of Kansas and shall be in a form and under such conditions as may be prescribed by the Director of Procurement and Contracts for surety bonds in accordance with K.S.A. 60-1112 and amendments thereto.

D. Each such certificate of deposit shall be retained by the State for at least six (6) months after the final acceptance of the work for which the contract was entered into. At the end of such time period, the certificate of deposit may be endorsed back to the Contractor if there are no claims by the State under the Contract or by any person making a claim against the certificate of deposit.

E. All interest accruing under any such certificate of deposit shall belong to the contractor unless the certificate of deposit is forfeited to the State of Kansas.

44. SIMULTANEOUS EXECUTION OF CONSTRUCTION CONTRACTS

A. In order to expedite the processing of Construction Contracts, bidders agree to the simultaneous execution of a copy of this document by all parties. After the execution of their copy of the agreement, the parties shall submit them to the State of Kansas, Procurement and Contracts, for assembly and may make a copy for their files if they wish. Upon receipt of all executed copies, and the submittal of the required bonds and insurance certificates, Procurement and Contracts shall date and assemble the copies and it shall constitute a binding

agreement as of the date of assembly. The assembled copies shall be retained in Procurement and Contracts, and a fully-executed set of contracts shall be delivered to the Contractor and State agency.

B. It is further agreed that if any party wishes to change any part of the Contract, they shall notify the Procurement and Contracts prior to signature. Procurement and Contracts shall review the request and if the changes are acceptable, a new contract shall be prepared and resubmitted to all parties for their signatures and processing as mentioned above.

45. EVALUATION

A. Bidders are advised that if awarded the Project, their performance will be evaluated by the Office of Facilities and Property Management with input from the State agency for whom the project is completed. This evaluation will remain on file and will be considered before the award of future projects. The Contractor, upon request, may receive a copy of the evaluations and prepare a response to the same. Responses will also be kept on file and considered in the same manner as the evaluations.

46. DRUG TESTING

A. Bidders are advised that in some circumstances federal regulations require drug testing of employees who install or maintain pipelines. Bidders should determine if drug testing is required on this project and include in its bid the complete cost for all such testing. Questions concerning these requirements should be directed to the Kansas Corporation Commission, Natural Gas Operations, 1500 S.W. Arrowhead Road, Topeka, Kansas 66604-4027, (785) 271-3100.

47. LICENSURE

A. All plumbing, electrical and heating, ventilation and air conditioning work on the job site shall be performed or supervised by a journeyman, with a current license in that particular trade. Licenses shall be available for inspection at the work site, and if a license is not available, work of that particular trade shall cease. Licenses from any state or political subdivision will be recognized. Licenses that require passage of Block/Experion tests are preferable.

END OF DOCUMENT D

DOCUMENT E - SUPPLEMENTAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SALES TAX DETERMINATION

A. Article 28 of the General Conditions shall be supplemented as follows:

1. This project has been determined by the Kansas Department of Revenue to be subject to Kansas sales tax. The cost of said Tax must be **INCLUDED IN** all Bid and Contract prices. Sales tax includes all applicable state, county and city sales taxes.

a. A general contractor or other contractor who contracts directly with the state of Kansas or one of its agencies shall pay tax as follows:

(1) Labor: No tax will be assessed since the labor is purchased directly by the State or one of its agencies.

(2) Materials: Taxes will be assessed on material purchased for the project.

b. A subcontractor on this project shall pay tax as follows:

(1) Labor: Taxes will be assessed because this labor is not purchased directly by the state or one of its agencies. (However, labor will not be taxed on projects calling for the original construction of a building or for repair or remodeling of a residence.)

(2) Materials: Taxes will be assessed on materials purchased for the project.

c. Whether sales tax should be paid to the Department of Revenue by a subcontractor on the subcontractor's labor services will depend upon whether the project qualifies as the original construction of a building or facility or as the repair or remodeling of a residence. The contractor and each subcontractor will be responsible for determining whether labor services for the project qualifies for such exemption and for including the correct amount of state, county and city sales tax applicable to this project. Contractors and subcontractors must include all sales tax due on materials, which are not exempt on this project. Any questions should be addressed to the Kansas Department of Revenue, Division of Taxation, Taxpayer Assistance Center, (785) 368-8222.

2. A general contractor or other contractor that contracts directly with the State of Kansas shall obtain copies of the Kansas Retailers Sales Tax Registration certificates from all its subcontractors on this project and have them available at the jobsite upon request.

1.2 ADDITIONAL CONDITIONS

A. The following Articles are additional or modified conditions of the construction contract:

1. Article 48. Insurance.

2. Article 49. Liquidated Damages.

3. Article 50. Weather Day Data.

48. INSURANCE

A. The Contractor shall not commence work under this Contract until the Contractor has obtained all the insurance required under this Article and such insurance has been approved by the Owner under the terms of this agreement. The Contractor shall not allow any subcontractor to commence work on the subcontract until the insurance required of the subcontractor has been so obtained and approved.

Companies providing insurance coverage must be authorized to transact the business of insurance in Kansas as an authorized insurer or eligible "non-admitted" insurer in accordance with K.S.A. 40-214 and K.S.A. 40-246e, respectively. Automobile liability and workers compensation insurance coverage

must be obtained from insurers that are "authorized" to transact the business of insurance in Kansas pursuant to K.S.A. 40-3103 and K.S.A. 44-532, respectively.

B. The Contractor shall procure and maintain at its expense, from the date of the Contractor's receipt of a Notice to Proceed until acceptance of the entire work by the Owner, the following insurance:

1. Worker's compensation insurance for the Contractor, all partners and employees working on the project. The Contractor shall require all subcontractors to provide workmen's compensation for themselves, their partners and employees to be engaged in such work unless the subcontractor's employees are covered by the Contractor's workers' compensation coverage. The Contractor and all subcontractors shall include employer's liability coverage with a one hundred thousand dollars ($100,000) limit for each accident; disease-policy limit; and disease-each employee limit.

2. Commercial general liability insurance, in an amount not less than five hundred thousand dollars ($500,000) each occurrence for bodily injury and property damage, a general aggregate of one million dollars and a products-completed operations aggregate of one million dollars ($1,000,000). Commercial general liability shall include the following coverages: operations; broad form property damage; completed operations; independent contractors and contractual.

3. Automobile liability insurance in an amount not less than five hundred thousand dollars ($500,000) for bodily injury and for property damage combined. Said coverage shall cover all owned, non-owned or hired vehicles of the contractor.

C. Scope of insurance and special hazards: The insurance provided under paragraph B above shall provide protection for the Contractor and his subcontractors against damage claims which may arise from operations under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by him, and also against any of the following special hazards which may be encountered in the performance of work under this Contract such as but not limited to: blasting, explosion, collapse, underground, rigging and hoisting, railroad protective, elevators and hoists.

D. Special form builder's risk: For this project, the principal contractor shall procure and maintain special form builder's risk insurance to include theft to protect the mutual interest of the owner and the contractor in an amount of one hundred percent (100%) of the contract price. No other contractor is required to carry the special form builder's insurance on this project. The insurance is to apply from the contractor's receipt of a Notice to Proceed until acceptance of the entire work by the owner.

E. The principal Contractor's property coverage shall name the Owner and all contractors and/or subcontractors performing work on the project as additional insureds.

F. The principal Contractor's general liability coverage (excluding professional liability) shall name the Owner and Project Architect/Engineer on the project as additional insureds.

G. Subcontractors' insurance: The contractor shall either (1) require each of his subcontractors to procure and maintain during the life of his subcontract commercial general liability insurance, and automobile liability insurance of the type and in the same amount specified in the preceding paragraphs; or (2) insure the activities of his subcontractors in his own policies.

H. Proof of insurance: The Contractor shall furnish the Owner with certificates showing the types, amounts, special coverages, effective dates and dates of expiration of policies. Such certificates shall provide the insurance company endeavor to give thirty (30) days notice of policy cancellation to the certificate holder.

49. LIQUIDATED DAMAGES

A. The Owner shall be entitled to liquidated damages to cover the costs of alternate facilities, extra observation, the salaries of contingent forces and other expenses incurred by the Owner due to delays in completion of the work caused by the Contractor.

Liquidated damages shall be assessed in an amount per day as indicated below for each calendar day between the adjusted contract completion date and the date of substantial completion of the project. After substantial completion if final project completion is not achieved prior to the adjusted contract completion date the Contractor shall pay for the Project Architect/Engineer's services; see Document D,

Article 23 M. The above amounts shall be deducted from the contract by contract change order prior to final payment. Such change order will not require approval of the Contractor.

B. Liquidated damages are established at the rate of **Two Hundred Fifty ($250.00) Dollars** per calendar day.

50. WEATHER DAY DATA

A. The following table indicates the number of weather days assumed for the area of the state in which this project is being completed. Reference Document D, Article 22 and Article 23 for further information concerning weather days and scheduling.

WEATHER ZONE 5

Counties included in this zone are:

Barber	Finney	Hamilton	Lane	Pratt	Stanton
Barton	Ford	Haskell	Meade	Rush	Stevens
Clark	Grant	Hodgeman	Morton	Scott	Wichita
Comanche	Gray	Kearney	Ness	Seward	
Edwards	Greeley	Kiowa	Pawnee	Stafford	

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY DAYS

January	4 days	May	9 days	September	5 days
February	4 days	June	8 days	October	4 days
March	6 days	July	7 days	November	3 days
April	6 days	August	7 days	December	3 days

END OF DOCUMENT E

DOCUMENT F - FORM OF CONTRACT (DA-141A)

DA Form 141a
(Rev. 11/2000)

THE STATE OF KANSAS
CONSTRUCTION CONTRACT
(For use when a single contract is awarded for the project as a whole, as authorized by K.S.A. 75-3741(b) as amended).

1. This Contract is made this by and between the , representing the State of Kansas and hereinafter referred to as the first party, and , , , , hereinafter referred to is the second party.

2. For and in consideration of the payments and agreements hereinafter mentioned, which are to be made and performed by the first party, the second party hereby agrees and contracts with the first party to commence and complete the construction described as follows:

(a) Project No. _____
(b) Title/Description: _____
(c) Location _____

hereinafter called the Project for the sum of:

Base Bid .....
Alternate 1.....

and all extra work in connection therewith, under the terms as stated in the Contract Document; and at the second party's own cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence, labor, insurance and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in the Contract Documents, prepared by the Project Architect (hereinafter referred to as the Architect/Engineer) or any designee of the Secretary of Administration who is vested with the authority and responsibility of the Architect/Engineer for this project.

The second party agrees to meet the following completion date:

Liquidated damages in the amount of $ per day will be assessed if the project is not completed as called for in the specifications.

3. For the purposes of this Contract, the term Contract Documents shall include the following:

(a) Notice to Bidders
(b) Instruction to Bidders
(c) The Bid Form
(d) Contractor's Performance Bond
(e) Contractor's Public Works Bond to the State
(f) General Conditions of the Contract
(g) Supplemental General Conditions
(h) The Specifications
(I) Drawings, maps, plans, etc., prepared by the Architect/Engineer or the designee of the Secretary of Administration
(j) Any duly issued addenda
(k) Any duly executed Contract Change Orders

It is hereby further agreed by the parties that the Contract Documents are intended to be complementary, so that any work included in one portion of the Contract Documents which is not included in another portion, should be executed by the second party as though the work was described in both portions.

4. The second party hereby agrees to use the services of the following subcontractors on this project:

(a) Electrical subcontractor:
(name)
(address)
(b) Mechanical subcontractor:
(name)
(address)
(c) Additional subcontractors, if any designated to perform any project alternates required by the Contract Documents which are listed in the Bid Proposal and which would change for (a) or (b) above:
(name)
(address .
(name)
(address)

The second party also agrees that no change or substitution may be made in the list of subcontractors without prior approval of the Secretary of Administration.

5. This contract shall be subject to, governed by, and construed according to the laws of the State of Kansas.

6. Anti-Discrimination Clause: The contractor agrees: (a) to comply with the Kansas Act Against Discrimination (K.S.A. 44-1001 et seq.) and the Kansas Age Discrimination in Employment Act (K.S.A. 44-1111 et seq.) and the applicable provisions of the Americans with Disabilities Act (42 U.S.C. 12101, et seq.) (ADA), and Kansas Executive Order No. 19-02, and to not discriminate against any person because of race, color, gender, sexual orientation, gender identity or expression, religion, national origin, ancestry, age, military or veteran status, disability status, marital or family status, genetic information, or political affiliation that is unrelated to the person's ability to reasonably perform the duties of a particular job or position; (b) to include in all solicitations or advertisements for employees, the phrase "equal opportunity employer"; (c) to comply with the reporting requirements set out at K.S.A. 44-1031 and K.S.A. 44-1116; (d) to include those provisions in every subcontract or purchase order so that they are binding upon such subcontractor or vendor; (e) that a failure to comply with the reporting requirements of (c) above or if the contractor is found guilty of any violation or

such acts by the Kansas Human Rights Commission, such violation shall constitute a breach of contract and the contract may be cancelled, terminated or suspended, in whole or in part, by the contracting state agency or the Kansas Department of Administration; (f) Contractor agrees to comply with all applicable state and federal anti-discrimination laws and regulations; (g) Contractor agrees all hiring must be on the basis of individual merit and qualifications, and discrimination or harassment of persons for the reasons stated above is prohibited; and (h) if it is determined that the contractor has violated the provisions of any portion of this paragraph, such violation shall constitute a breach of contract and the contract may be canceled, terminated or suspended, in whole or in part, by the contracting state agency or the Kansas Department of Administration.

7. Acceptance of Contract. This contract shall not be considered accepted, approved or otherwise effective until the statutorily required approvals and certifications have been rendered, and until funds for the contract have been encumbered.

8. Arbitration, Damages, Warranties. Notwithstanding any language to the contrary, no interpretation of this contract shall be allowed to find the state or any agency thereof has agreed to binding arbitration, the payment of damages or penalties upon the occurrence of a contingency, or to permit disclaimer of any or all warranties.

9. Termination Due to Lack of Funding Appropriation. If appropriated funds are withdrawn from the project through legislative action and sufficient funds are not available to continue the function performed in this agreement or pay for the charges hereunder, the first party may terminate this agreement. The first party agrees to give written notice of termination to the second party at least 30 days in advance of termination. First party will pay to the second party all regular contractual payments due for work incurred prior to termination. The termination of the contract pursuant to this paragraph shall not cause any penalty to be charged to the first party.

10. Disclaimer of Liability. Neither the State of Kansas nor any agency thereof shall hold harmless or indemnify any contractor for any liability whatsoever.

11. Representative's Authority to Contract. By signing this document, the representative of the second party thereby represents that such person is duly authorized by the second party to execute this document on behalf of the second party and that the second party agrees to be bound by the provisions thereof.

12. Terms Herein Controlling Provisions. It is expressly agreed that the terms of each and every provision in this contract shall prevail and control over the terms of any other conflicting provision in any other document relating to this agreement.

13. The second party binds itself, its partners, heirs, executors, successors, assigns and legal representatives to all covenants of this agreement.

14. The second party shall not assign, sublet or transfer any interest in this agreement without the written consent of the Secretary of Administration.

15. The Eleventh Amendment is an inherent and incumbent protection with the State of Kansas and need not be reserved, but prudence requires the State to reiterate that nothing related to this contract shall be deemed a waiver of the Eleventh Amendment.

In order to expedite the processing of this agreement, the parties mutually agree to the simultaneous execution of a copy of this document by all parties and persons mentioned below. After the execution of their copy of the agreement, the individuals shall submit them to the State of Kansas, Division of Purchases, for assembly and may make a copy for their files if they wish. Upon receipt of all executed copies, and the submittal of the required bonds and insurance certificates, the Division of Purchases shall date and assemble the copies and it shall constitute a binding agreement as of the date of assembly. The assembled copies shall be retained in the Division of Purchases, and a fully-executed set of contracts shall be delivered to the contractor and state agency. It is further agreed that if any individual wishes to change any part of the agreement, they shall notify the Division of Purchases, who shall prepare a new agreement and resubmit it to all parties and persons mentioned below for their signatures and processing as mentioned above.

Signed this by the respective parties as follows:

STATE OF KANSAS, FIRST PARTY	SECOND PARTY
By: _____	By: _____
State Agency	Company Name
_____	_____
Head of State Agency	Authorized Signature
_____	_____
Director of Purchases	FEIN

APPROVED:

_____

Director of Facilities and Property Management

DOCUMENT G - FORM OF PERFORMANCE BOND

PERFORMANCE BOND

We, _____
Name Address

as Principal, hereinafter called Contractor, and _____, a corporation organized under the laws of the State of _____, with its home office in the city and state of _____, as Surety and hereinafter referred to as Surety, are held and firmly bound unto the State of Kansas, as Obligee, hereinafter called the State, in the sum of _____ dollars ($_____) for the payment of which sum we as Contractor and Surety bind ourselves and our legal representatives and successors, jointly and severally, by this instrument.

WHEREAS, Contractor has by written agreement dated _____, 201_____, entered in to a contract with the State of Kansas for

_____

_____

_____

_____

in accordance with plans and specifications set forth in the State of Kansas, project #_____ and RFQ #_____, and which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

IT IS THEREFORE the condition of the above obligation that whenever Contractor shall be in default and is declared by the State to be in default under the Contract, the State having performed the State's obligations under the Contract, the Surety will promptly remedy the default by completion of the Contract and correction of defective work in accordance with the terms and conditions of the Contract. This includes repairs required by the guarantees and warranties called for in the Contract. It also includes additional legal, design professional, delay costs and liquidated damages resulting from the Contractor's default. The Surety waives notice of any change, including changes of time to complete the Contract.

If surety does not promptly remedy the default, the Surety shall be liable to the State for funds sufficient to pay the cost of completion and other obligations in the above paragraph, less the balance of the contract price. Balance of contract price shall mean total amount payable by the State to Contractor under the Contract, less amounts previously paid to Contractor by the State. If Contractor faithfully, promptly and accurately completes the Contract and complies with all the conditions thereof, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

IN WITNESS WHEREOF, we have hereunto set our hands this _____ day of _____, 201_____.

Principal _____

By: _____
(Title)

Surety _____ _____
(Kansas Resident Agent - if required)

Address _____ Address _____

By: _____
(Attorney in Fact)

DOCUMENT H - FORM OF PUBLIC WORKS BOND

CONTRACTOR'S PUBLIC WORKS BOND TO THE STATE
(Pursuant to K.S.A. 60-1111 as amended)

We, _____
Name

_____
Address

_____, as Principal,

and _____

_____

as Surety, are held firmly bound unto the STATE OF KANSAS, in the sum of _____

_____DOLLARS,

well and truly to be paid, to which payment we hereby bind ourselves, our heirs, executors, administrators, successors or assigns, jointly and severally.

The condition of the above obligation is that the Principal and Surety agree to pay all indebtedness incurred for labor, materials, equipment or supplies furnished in the performance of the construction contract by the contractor and his subcontractors for the following public building or improvement,

_____

_____

_____

in accordance with plans and specifications of Project No. _____ on file in the Department of Administration, Office of Facilities and Property Management. The surety waives notice of any change, including changes of time to complete the contract.

NOW, THEREFORE, if the said contractor and all sub-contractors, if any, of said contractor shall pay all indebtedness incurred for labor furnished, materials, equipment or supplies used or consumed in connection with, or in or about the construction of said public building or making said public improvements, then the above obligation shall be void, otherwise it shall remain in full force and effect.

IN WITNESS WHEREOF, We have hereunto set our hands this _____ day of _____, 201____ .

Principal: _____

By: _____
(Title)

_____

Surety: _____

By: _____

_____

DOCUMENT I - FORM OF APPOINTMENT OF SERVICE AGENT

Office of the Secretary of State / Corporations Division

Form **S1**

Appointment of Service Agent

(Note: Nonresident contractors under K.S.A. 16-113 who are foreign corporations, foreign limited partnerships or foreign limited liability companies qualified to do business and in good standing in Kansas are not required to file this form.)

1. _____
(Name of individual, partnership, association or corporation)
hereby appoints for three years:

_____
(Name of service agent--must be Kansas resident)

as agent for service of process pursuant to K.S.A. 60-306.

Do not write in this space

2. The address of the service agent in Kansas is:

_____
(Street address or rural route)

_____
(City) (County) (Zip code)

3. In testimony whereof, I _____, of said entity, hereunto

subscribe my name this _____ day of _____, A.D. 201___.

_____
(Signature)

State of _____
} ss.
County of _____

Acknowledged before me this _____ day of _____, 201__.

My appointment or commission expires _____.

Affix an impression of notary's seal here:

_____
(Notary's Signature)

Please submit this document, properly notarized with $20 filing fee, to:
Secretary of State, Corporation Division, 1st Floor, Memorial Hall,
120 SW 10th Ave. Topeka, Kansas 66612; (785) 296-4564.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01 0000 – STATE OF KANSAS REQUIREMENTS

PART 1 - GENERAL

1.0 OVERVIEW

A. In case of conflicts between the State of Kansas information (Document A through Document I and Section 01 0000) and the technical specifications provided by the design team, the State of Kansas information prevails.

1.1 CONTACT INFORMATION FOR THE OFFICE OF FACILITIES MANAGEMENT

1. **USPS:** Office of Facilities and Property Management, Design, Construction & Compliance, Department of Administration, 700 Harrison Street, Suite 1200, Topeka, Kansas 66603.

2. **Shipping address (via courier):** Office of Facilities and Property Management, Design, Construction & Compliance, Department of Administration, 700 Harrison Street, Suite 1200, Topeka, Kansas 66603.

3. **Electronically:** Visit our website at http://admin.ks.gov/offices/ofpm/dcc.

4. **Telephonically**: (785) 296-8899.

1.2 PRE-CONSTRUCTION CONFERENCE

A. The successful Bidder shall agree to attend a pre-construction conference along with persons responsible for the various operations involved with the Project.

1.3 COORDINATION WITH OWNER

A. The Owner will make the necessary arrangements to cause the Work area to be available to the Contractor. Access and egress to the Work area shall be routes prescribed by the Owner.

B. The prospective Bidder shall visit the site and ascertain the extent of the Work to be done under the Contract and the conditions under which it must be performed.

C. The prospective Bidder shall make his own estimates and verify all dimensions of areas on the job.

D. The prospective Bidder shall familiarize himself with the traffic regulations and parking and storage areas he will become involved with if he becomes the Contractor. The Contractor shall inform his workmen of these regulations and conditions. Parking and storage areas shall be as designated by the Owner.

E. Contact **Carl Anderson, Assistant Laboratory Director, Kansas Bureau of Investigation, 625 Washington Street, Great Bend, Kansas 67530** at telephone number **620-603-7124,** e-mail address **carl.anderson@kbi.ks.gov,** for assistance in exploring the area(s) of Work.

1.4 CONSTRUCTION PROGRESS MEETINGS

A. Construction progress meetings will be held at the project site at a minimum, every 30 days, (monthly) while construction is on-going unless otherwise directed by the project architect/engineer. Coordinate dates of meetings with preparation of the payment request. These meetings are mandatory.

1.5 CERTIFICATE OF PROJECT COMPLETION

A. Upon final completion of the work under the Contract, a formal Certificate of Project Completion will be forwarded to the Contractor by the Architect/Engineer. The date of the certificate shall be the starting date of the guarantee or warranty period for all guarantees or warranties.

1.6 OPERATION AND MAINTENANCE DATA

A. Bind operation and maintenance data in 8-1/2" x 11" text pages.

B. Binder covers shall have printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," "title of project" and "project number."

C. Internally subdivide binder contents with permanent page dividers, logically organized, with tab titling clearly printed under reinforced laminated plastic tabs.

D. If required by the agency, submit one (1) hard copy of the operation and maintenance data, in a 3-ring binder to the Owner/agency.

E. One (1) electronic copy of the paper submission, on a flash drive, shall accompany the hard copy.

1.7 PROJECT CLOSEOUT CHECKLIST

A. The document below is for use by the project architect/engineer, contractor and Owner to verify all items related to final completion are provided before final payment is released to the contractor.

PROJECT CLOSEOUT CHECKLIST

CONTRACTOR MUST HAVE THE FOLLOWING ITEMS COMPLETED AND APPROVED TO RECEIVE FINAL PAYMENT.
Check when complete or write NA in the blank if not applicable

____ Punchlist items

____ All warranties and instructions have been delivered to the Owner.

____ All keys have been delivered to the Owner.

____ All maintenance equipment and tools have been delivered to the Owner.

____ All extra materials and spare parts have been delivered to the Owner.

____ Certificate of (Partial) Occupancy

____ If Commissioning is the responsibility of the contractor, it has been completed and commissioning report has been delivered to the Architect/Engineer.

____ If Testing and Balance is the responsibility of the contractor, approved reports have been completed and delivered to the Architect/Engineer.

____ In projects which have security related design elements, the architect and engineer shall return all security related shop drawings to the Owner.

____ O and M manuals have been delivered to the project Architect/Engineer, have been reviewed for completeness and have been delivered to the Owner.

____ Training and demonstrations of as required by the specifications has been completed.

____ Record Documents have been delivered to the project Architect/Engineer. (Reference Document D – General Conditions of the Contract Article 17 paragraph AA)

____ Final Cleaning has occurred to the satisfaction of the Owner and project Architect/Engineer.

____ Certificate of Occupancy executed by the Office of Facilities and Property Management is on file.

A copy of this form shall be submitted to OFPM along with the Affidavit of Contractor & Certificate of Project Completion.

END OF SECTION 01 0000

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work performed by Owner.
4. Work under Owner's separate contracts.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

B. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 7300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

A. Project Identification: Kansas Bureau of Investigation (KBI) Forensic Laboratory Renovation.

1. Project Location: 625 Washington Street, Great Bend, KS 67530.

B. Owner: Kansas Bureau of Investigation, 625 Washington Street, Great Bend, KS 67530.

1. Owner's Representative: Eric Moore, Project Manager, Forensic Science Laboratory, Kansas Bureau of Investigation.

C. Architect: GLMV Architecture, Inc., 1525 E Douglas, Wichita, KS 67211, 316-265-9367.

1. Architect's Representative: Paul J. Michell, 316-265-9367, paul.michell@glmv.com.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Mechanical, Electrical, and Plumbing Engineering: Brack & Associates Consulting Engineers.

E. Web-Based Project Software: If Alternate 3 is selected, Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 01 3100 "Project Management and Coordination" for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Renovation of an 1,800-square-foot portion of the first floor of the KBI Forensic Laboratory in Great Bend, Kansas. This includes renovation of 1 laboratory, associated support and storage spaces, 4 offices, above-ceiling/ceiling corridor improvements, and other Work indicated in the Contract Documents.

B. Type of Contract: Project will be constructed under a single prime contract.

1.5 WORK PERFORMED BY OWNER

A. 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. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before Work under this Contract begins.

1. Removal and storage of small furnishings, artwork, files, and personal materials of the Owner in the Project area.

a. The General Contractor shall be responsible for the removal of all office furniture, file cabinets, storage cabinets, and similar items. Contractor shall surrender to the Owner at their preferred storage location or dispose of, as directed by the Owner.

C. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.

1. Installation of any small furnishings, fixtures, art, and equipment not covered by the Work of the Owner’s separate vendors indicated herein.

1.6 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

B. Concurrent Work: Owner will award and will assign to Contractor separate contract for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

1. Hazardous Materials Abatement: The Owner shall select and contract with 1 of their preferred abatement contractors for the removal of ductwork and associated asbestos-containing materials.

a. Coordination, sequencing, and scheduling of this abatement and demolition work with all other demolition work required by the Contract Documents shall be the responsibility of the General Contractor. The Contractor shall ensure that work progresses without delay and without detrimental effect to the successful completion of the Project.

2. Technology and Structured Cabling Systems: The Owner shall contract with their current equipment and system vendor for the installation of cabling, devices, and other equipment. Conduit, junction boxes, high-voltage power (if any), and other necessary infrastructure indicated in the Contract Documents shall be the responsibility of the General Contractor.
3. Fire Alarm Systems: The Owner shall contract with their current equipment and system vendor for the installation of cabling, devices, and other equipment. Conduit, junction boxes, high-voltage power (if any), and other necessary infrastructure indicated in the Contract Documents shall be the responsibility of the General Contractor.
4. Security, Surveillance and Intrusion Detection: The Owner shall contract with their current equipment and system vendor for the installation of cabling, devices, and other equipment. Conduit, junction boxes, high-voltage power (if any), other required door hardware, and other necessary infrastructure indicated in the Contract Documents shall be the responsibility of the General Contractor.

C. Subsequent Work: Owner will award separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.

1. Furniture, Fixtures and Equipment (FF&E): The Owner will award separate contract(s) for the final design, manufacture, supply, delivery, and installation of new office furnishings for the renovated Project area.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site and Building: Limit use of Project site and building to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Path of Egress: Keep egress paths within building clear, well-lit, and usable at all times the building is occupied. Demolition and construction work shall only occur when the building, or affected areas of the building, is unoccupied.
2. Unauthorized Areas: Generally, any areas outside of the noted Project area shall be considered closed to the operations and personnel of the Contractor. At no times shall the Contractor, their personnel, or their subcontractors access, or attempt to gain access to, these areas. Coordinate with the Owner for supervised access to other portions of the facility for the purpose of completing Work required by the Contract Documents.
3. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for 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. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

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

1.9 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 4:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: Only for the purpose of completing work in egress paths while affected areas of the facility are unoccupied. Coordinate with Owner for scheduling.
2. After-hours Work: Between 4:00 p.m. and 11:00 p.m. only for the purpose of completing work in egress paths while affected areas of the facility are unoccupied. Coordinate with Owner for scheduling.

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

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

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

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

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

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

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

1.10 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. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

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

D. 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 scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. 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 or deducted from 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 or credit 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.

1.4 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. Alternate 1: Building East Wing Remodel.

1. Amount the Base Bid would change to perform all remodel work within New Evidence 115, Office 127, and Office 127A.

B. Alternate 2: Lab Casework.

1. Amount the Base Bid would change to provide all new lab casework as indicated within Project Documents (re: Sheets A101, I-401, I-402, I-501, I-502, and IF-101).

C. Alternate 3: New Wall - Chemical Storage 110.

1. Amount the Base Bid would change to remove existing wall between Chemical Storage 110 and Instrument Lab 111, and to construct new wall further south to provide for larger Instrument Lab 111 space. Door 111 would also be located further south.

D. Alternate 4: New Ventilated Lockers.

1. Amount the Base Bid would change to provide new ventilated lockers, in lieu of tall storage cabinets, within Evidence 108 (re: Sheets A101, I-401, and IF-101).

E. Alternate 5: New Interior Window W2.

1. Amount the Base Bid would change to provide new hollow metal fixed window within corridor wall at Instrument Lab 102.

F. Alternate 6: Lab Equipment.

1. Amount the Base Bid would change to provide and install new lab equipment as indicated on Sheet A101.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 2300 "Alternates" for products selected under an alternate.
2. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

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

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 to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form acceptable to Architect.
2. 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.
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.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 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 7 days of receipt of additional information or documentation, whichever is later.

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 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 1 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: Architect will consider requests for substitution if received within 15 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    b. Requested substitution does not require extensive revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    d. Substitution request is fully documented and properly submitted.
    e. Requested substitution will not adversely affect Contractor's construction schedule.
    f. Requested substitution has received necessary approvals of authorities having jurisdiction.
    g. Requested substitution is compatible with other portions of the Work.
    h. Requested substitution has been coordinated with other portions of the Work.
    i. Requested substitution provides specified warranty.
    j. If requested substitution involves more than 1 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 01 3100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

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, on AIA Document G710 or another form acceptable to the Owner.

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

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

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on Owner’s standard form.

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 01 2600

SECTION 01 2900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 3200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect at earliest possible date, but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Owner’s Form 450a for schedule of values. 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. Arrange schedule of values consistent with format of Owner’s Form 450a.
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 in excess of 5 percent of the Contract Sum.
3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

4. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
5. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling 5 percent of the Contract Sum and subcontract amount.
7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least 1 separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

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

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

C. Application for Payment Forms: Use Owner’s Form 450 as form for Applications for Payment.

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

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

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

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

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

F. Transmittal: Submit 1 signed and notarized electronic copy of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

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

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

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

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Schedule of unit prices.
5. Submittal schedule (preliminary if not final).
6. Initial progress report.
7. Report of preconstruction conference.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 7700 "Closeout Procedures."

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

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. Evidence that claims have been settled.
6. Final liquidated damages settlement statement.
7. Proof that taxes, fees, and similar obligations are paid.
8. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The web-based Project software indicated as part of this Section is covered by Alternate 3. Refer to Section 12300 “Alternates.”

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. Web-based Project management software package.
6. Project meetings.

B. Related Requirements:

1. Section 01 3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 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, 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, in web-based Project software directory, and in prominent location in built facility. 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. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

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

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 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 submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

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

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

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

1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 7 days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

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

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 3 days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect 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. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Architect.

    a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Architect.

4. The following digital data files will be furnished for each appropriate discipline:

    a. Floor plans.
    b. Reflected ceiling plans.

B. Web-Based Project Management Software Package (Alternate 3): Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    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, Construction Change Directives, and Change Orders.

e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for 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 and Specifications, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to 8 Project management software user licenses for use of Owner, Architect, and Architect's consultants. Provide software training via webinar or video conference for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, 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.

1.8 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 7 days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

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

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long-lead items.

e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software (if Alternate 3 is selected).
h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Preparation of Record Documents.
o. Use of the premises and existing building.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

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

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity 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 Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Possible conflicts.
i. Compatibility requirements.
j. Time schedules.
k. Weather limitations.
l. Manufacturer's written instructions.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities and controls.
q. Space and access limitations.
r. Regulations of authorities having jurisdiction.

s. Testing and inspecting requirements.
t. Installation procedures.
u. Coordination with other work.
v. Required performance results.
w. Protection of adjacent work.
x. 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. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site use.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of Proposal Requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Material location reports.
5. Site condition reports.
6. Unusual event reports.

B. Related Requirements:

1. Section 01 4000 "Quality Requirements" for schedule of tests and inspections.
2. Section 01 2900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at weekly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

H. Unusual Event Reports: Submit at time of unusual event.

I. Qualification Data: For Project scheduler.

1.5 QUALITY ASSURANCE

A. Scheduling Qualifications: An experienced specialist in scheduling and reporting.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Discuss constraints, including work stages, area separations, interim milestones, and partial Owner occupancy.
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review submittal requirements and procedures.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.
7. Review time required for Project closeout and Owner startup procedures.
8. Review and finalize list of construction activities to be included in schedule.
9. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Project Scheduler: Employ or engage skilled personnel to provide planning, evaluation, and reporting.

C. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

D. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Owner interfaces and furnishing of items.
    d. Interfaces with Separate Contracts.
    e. Regulatory agency approvals.
    f. Punch list.

3. Procurement Activities: Include procurement process activities for the following long-lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 3300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner or the Owner’s separate contractors.
2. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.

c. Uninterruptible services.
d. Use-of-premises restrictions.
e. Seasonal variations.
f. Environmental control.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.9 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.

7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within 1 day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3200

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

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

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

1.4 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 Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit within 14 days of date established for commencement of the Work. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

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

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

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

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 Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals Utilizing Web-Based Project Software (Alternate 3): Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

    a. Architect will return annotated file. Annotate and retain 1 copy of file as a digital Project Record Document file.

2. Web-Based Project Management Software (Alternate 3): Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 5 days for review of each resubmittal.

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

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

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 Architect's action stamp.

1.7 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 concurrently 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 unless submittal based on Architect's digital data drawing files is otherwise permitted.

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

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.

C. Samples: Submit Samples for review of type, 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. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Web-Based Project Management Software (Alternate 3): Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. 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 not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. 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 1 full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

7. 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 3 sets of Samples. Architect will retain 1 Sample set; remainder will be returned. Mark up and retain 1 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 3 sets of paired units that show approximate limits of variations.

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

E. 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.

F. 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 AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

G. 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 substrate preparation and primers required.
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.

1.8 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 Architect.

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

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

1.9 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 submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. 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. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

2. Submittals by Web-Based Project Management Software (Alternate 3): Architect will indicate, on Project management software website, the appropriate action.

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

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

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

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3300

SECTION 01 3516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes special procedures for alteration work.

1.3 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

A. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns and adjacent to restricted areas. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.

1.5 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at Project site.

1.6 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label 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 unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.

3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 degrees F or more above the dew point.

1.7 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs and/or preconstruction videotapes.

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the Owner has removed all items necessary and not required of the contractor to remove and surrender to Owner.

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch

personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

a. Train each fire watch in the proper operation of fire-control equipment and alarms.
b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
e. Maintain fire-watch personnel at each area of Project site until 30 minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings.

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 01 3516

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspection services may be 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of 5 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.

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

C. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National

Voluntary Laboratory Accreditation Program (NVLAP), or by 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 Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

H. 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.

I. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED DESIGN SERVICES

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

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

B. Delegated Design Services Statement: Submit a statement 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, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with 2 or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 INFORMATIONAL SUBMITTALS

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

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

C. Reports: Prepare and submit certified written reports and documents as specified.

D. Permits, Licenses, and Certificates: For Owner's record, 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.

1.7 REPORTS AND DOCUMENTS

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

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address 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 inspection.
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 reinspecting.

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

1. Name, address, telephone number, and email address 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 of 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, telephone number, and email address 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 of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

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

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

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

F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

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

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

1.9 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.

2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

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

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. Engage a qualified testing agency to perform quality-control services.

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

3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspection 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 inspection 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. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

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

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

E. 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."

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

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

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

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

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, 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 01 4000

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, field office, and security and protection facilities.

B. Related Requirements: Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. Installation, removal, and use charges for field office shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Electric Power Service for Field Office: Pay electric-power-service use charges for electricity used by all entities.

C. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges within existing facility for interior construction operations. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges within existing facility for interior construction operations. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show field office, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

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

5. Other dust-control measures.

C. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:

1. Methods used to meet the goals and requirements of the Owner.
2. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
3. Indicate locations of sensitive laboratory areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.5 QUALITY ASSURANCE

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

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

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

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

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, such as file cabinets, plan tables, plan racks, and bookcases.
2. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than 1 receptacle on each wall.
3. Drinking water.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 degrees F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds and Portable Containers: Provide sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with 4-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

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

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

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

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

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

1. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, egress, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide cellular telephone service for Contractor’s construction personnel. Install WiFi cell phone access equipment for field office.

1. At each field office, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

H. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

I. Project Computer: Provide a mobile or desktop computer in the primary field office adequate for use by Contractor’s personnel to access Project electronic documents and maintain electronic communications.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

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

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

C. Parking: Provide temporary offsite parking areas for construction personnel.

D. Storage and Staging: Use designated areas of Project site for storage and staging needs.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs, so they are legible at all times.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 7300 "Execution."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 1000 "Summary."

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

D. Staging Area Fence: Before construction operations begin, furnish and install enclosure fence in a manner that will protect exterior staging areas from theft and vandalism.

1. Extent of Fence: Where directed by Owner.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish 1 set of keys to Owner.

E. Temporary Egress: Maintain egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to egress.

F. Covered Walkway: If Alternate 2 is selected, erect protective, covered walkway for passage of individuals through work area. Coordinate with existing facility and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior, if required.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

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

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

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

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 01 1000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 01 2500 "Substitution Procedures" for requests for substitutions.
3. Section 01 7700 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

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

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: 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. Manufacturer's

published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the Specifications, select another named product or product from another named manufacturer that does meet the requirements of the Specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between 2 or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

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

1.7 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to 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 in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. 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 unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. 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 1 of the other named manufacturers. Drawings and Specifications may additionally 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 01 2500 "Substitution Procedures" for substitutions for convenience.

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

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following 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.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. 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.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

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

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.

B. Related Requirements:

1. Section 01 1000 "Summary" for coordination of Owner-furnished products, Owner-performed work, Owner's separate contracts, and limits on use of Project site.
2. Section 01 3300 "Submittal Procedures" for submitting surveys.
3. Section 01 7700 "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.
4. Section 02 4119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

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

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

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Plumbing piping systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Electrical wiring systems.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

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

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

C. 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 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning Work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

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 Owner that is necessary to adjust, move, or relocate existing utility structures, 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, submit a request for information to Architect in accordance with requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.

3.4 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

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 satisfactory results as judged by Architect. 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 of type expected for Project.

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: 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 with manufacturer.

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

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

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 CUTTING AND PATCHING

A. 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 in accordance with requirements in Section 01 1000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. 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 eliminate 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, corner to corner of wall and edge to edge of ceiling. 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 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's separate contractors.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. 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 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees 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.

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

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

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

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

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

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

G. 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 01 5000 "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 AND REPAIR 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. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. 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.

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

END OF SECTION 01 7300

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 01 7823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 01 7839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 01 7900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 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.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements.
9. 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 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of

items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. 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.

1.8 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 2900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

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

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

1.9 LIST OF INCOMPLETE ITEMS

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

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding through interior areas, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel Electronic File: Architect will return annotated file.
    b. PDF Electronic File: Architect will return annotated file.

c. Web-Based Project Software (Alternate 3) Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect 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. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. 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 on digital media acceptable to Architect, by uploading to web-based Project software site (Alternate 3), or by email to Architect.

D. 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 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
k. 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.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 5000 "Temporary Facilities and Controls."

D. Provide additional cleaning after Substantial Completion at areas where subsequent punch list work is completed. Facility and site shall be clean at the time of Owner occupancy.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements: Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

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

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

1.4 CLOSEOUT SUBMITTALS

A. 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. Architect 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 on digital media acceptable to Architect, by uploading to web-based project software site, if used, or by email to Architect. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 15 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.
2. Furnish 1 final paper copy of Closeout Submittals to the Owner after correcting in accordance with the Architect’s comments.

E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 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, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2- by 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If 2 or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

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

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

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

1.6 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 Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

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

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

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. 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."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

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

1.8 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.

1.9 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.

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

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.

1.10 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.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

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

D. 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.

E. 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.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

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

G. 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.

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

I. 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.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

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

D. 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.

E. 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.

F. Repair Materials and Sources: Include lists of materials and local sources of 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

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

B. Related Requirements:

1. Section 01 7300 "Execution" for final property survey.
2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and 1 set of file prints.
2) Submit Record Digital Data Files and 1 set of plots.
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned Record Prints and 3 sets of file prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including Addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

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

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

1.4 RECORD DRAWINGS

A. Record Prints: Maintain 1 set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding 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. Revisions to routing of piping and conduits.
    d. Revisions to electrical circuitry.
    e. Actual equipment locations.
    f. Duct size and routing.
    g. Locations of concealed internal utilities.
    h. Changes made following Architect's written orders.
    i. Details not on the original Contract Drawings.
    j. Field records for variable and concealed conditions.
    k. 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 prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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

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

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

1.5 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. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain 1 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 annotated PDF electronic file.

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

1.7 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 (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

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

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

1.4 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 7823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

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

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

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

1.7 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.

1.8 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 01 7823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

    1. Owner will furnish Contractor with names and positions of participants.

B. 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 with at least 7 days' advance notice.

C. 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.

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

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 7900

SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related requirements include Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

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

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

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

1.5 PREINSTALLATION MEETINGS

A. Pre-Demolition Conference: Conduct conference at the Project site.

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

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

C. 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 and other tenants that on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Pre-Demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

E. 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.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items: Furniture.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

1. Fume hood.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured Drawings and preconstruction photographs or video as approved by Owner.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Approve all photographs or video with Owner’s representative.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.

7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. 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. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. 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.

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

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4-inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and 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." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

END OF SECTION 02 4119

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section covers alternate scope work, including roof rafter framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Participants: General Contractor and Installer.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips.
6. Single deflection track.
7. Double deflection track.
8. Drift clips.
9. Floor joist framing.
10. Roof-rafter framing.
11. Ceiling joist framing.
12. Soffit framing.
13. Post-installed anchors.
14. Power-actuated anchors.
15. Sill sealer gasket.
16. Sill sealer gasket/termite barrier.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AllSteel & Gypsum Products, Inc.
2. CEMCO; California Expanded Metal Products Co.
3. ClarkDietrich.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Manufacturing, Inc.
6. Custom Stud.

7. Design Shapes in Steel.
8. Formetal Co. Inc. (The).
9. Jaimes Industries.
10. MarinoWARE.
11. MBA Building Supplies.
12. MRI Steel Framing, LLC.
13. Nuconsteel, A Nucor Company.
14. Olmar Supply, Inc.
15. SCAFCO Steel Stud Company.
16. Southeastern Stud & Components, Inc.
17. State Building Products, Inc.
18. Steel Construction Systems.
19. Steel Structural Systems.
20. Steeler, Inc.
21. Super Stud Building Products Inc.
22. Telling Industries.
23. The Steel Network, Inc.
24. United Metal Products, Inc.
25. United Steel Deck, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Roof Systems: AISI S210.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677-inch.
2. Flange Width: 1-5/8 inches, minimum.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.

3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

2.6 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8-inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8-inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16-inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: 12 inches.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

3.4 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8-inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-staining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

C. Field-Adhesion-Test Reports: For each sealant application tested.

D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.4 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance).

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces - polyurethane.

1. Joint Locations:

a. Control and expansion joints in tile flooring.
b. Other joints as indicated on Drawings.

B. Joint-Sealant Application: Interior joints in vertical surfaces not subject to significant movement - latex.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Vertical joints on exposed surfaces of walls and partitions.
c. Other joints as indicated on Drawings.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces – mildew resistant silicone.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Lab casework.
c. Other joints as indicated on Drawings.

END OF SECTION 07 9200

SECTION 08 1213 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes interior standard steel frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each frame type.
2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with 2 removable spreader bars across bottom of frames, tack-welded to jambs and mullions.

C. Store hollow metal frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Gensteel Doors, Inc.
4. Steelcraft; an Allegion brand.

2.2 STANDARD STEEL FRAMES

A. Construct hollow metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Interior Frames: SDI A250.8. At locations indicated in the Door and Frame Schedule.

1. Materials: Uncoated steel sheet, minimum thickness of 0.053-inch.
2. Construction: Full profile welded.
3. Exposed Finish: Prime.

2.3 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053-inch.

B. Construction: Full profile welded.

C. Fabricate in 1 piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of 3 anchors per jamb, with 1 additional anchor for frames with no floor anchor. Provide 1 additional anchor for each 24 inches of frame height above 7 feet.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

2.6 FABRICATION

A. Hollow Metal Frames: Fabricate in 1 piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive 3 door silencers.

B. Hardware Preparation: Factory prepare hollow metal frames to receive templated mortised hardware and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow metal frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap frames to receive non-templated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.

B. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

1. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
2. Install frames with removable stops located on secure side of opening.

C. Floor Anchors: Secure with post-installed expansion anchors.

1. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

D. Solidly pack mineral-fiber insulation inside frames.

E. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

F. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

G. Installation Tolerances: Adjust hollow metal frames to the following tolerances:

1. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

3.3 CLEANING AND TOUCHUP

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 1213

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory machining for hardware.

B. Related requirements include Section 08 1213 “Hollow Metal Frames” for wood doors set inside hollow metal frames.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of door, including the following:

1. Door core materials and construction.
2. Door edge construction.
3. Door face type and characteristics.
4. Factory-machining criteria.
5. 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. Apply AWI Quality Certification Program label to Shop Drawings.
8. Samples for Initial Selection: for factory-finished doors.

C. Samples for Verification: Factory finishes applied to actual door face materials, with door faces and edges representing actual materials to be used, approximately 8 by 10 inches, for each material and finish**.**

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

B. Special warranties.

1.7 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.

1.8 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.

1.9 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. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4-inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01-inch in a 3-inch span.

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

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

2.2 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

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. Eggers Industries.
   b. Lambton Doors.
   c. Masonite Architectural.
   d. Oshkosh Door Company.
   e. VT Industries, Inc.
   f. Manhattan Door

B. Performance Grade:

1. Grade: Premium, with Grade A faces.
2. Species: Red oak, stained to match existing.
3. Cut: Rift cut.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Glued wood stave or structural composite lumber (SCL).
9. Construction: 5 plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

C. Glazing: Provide 1/4-inch fully tempered, quality Q4 glazing.

2.3 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated. 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. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.4 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 4 edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 7100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standards, and as indicated.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8-inch at heads, jambs, and between pairs of doors. Provide 1/8-inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide1/4-inch from bottom of door to top of threshold unless otherwise indicated.

a. Bevel non-fire-rated doors 1/8-inch in 2 inches at lock and hinge edges.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations to determine if replaced or repaired door assembly installations comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 08 4113 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section covers alternate scope work, including exterior storefront framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For aluminum-framed storefronts, for tests performed by manufacturer.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Water penetration through fixed glazing and framing areas.
d. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: 20 psf.
2. Other Design Loads: As indicated on Drawings.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4-inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8-inch, whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

D. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area: Maximum air leakage of 0.06-cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 8 lbf/sq. ft. as defined in AAMA 501.

G. Energy Performance: Certify and label energy performance according to AAMA as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.47-Btu/sq. ft. x h x deg F as determined according to AAMA 1503.
2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 54 as determined according to AAMA 1503.

H. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 30.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 degrees F.
b. Low Exterior Ambient-Air Temperature: -10 degrees F.
c. Interior Ambient-Air Temperature: 75 degrees F.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Alcoa company; Trifab 451T or a comparable product by one of the following:

1. EFCO Corporation.
2. Oldcastle BuildingEnvelope.
3. U.S. Aluminum; a brand of C.R. Laurence.

B. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on 4 sides.
3. Glazing Plane: Center.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 VENTING WINDOWS

A. Aluminum Windows: Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:

1. Window Type: Casement.
2. Minimum Performance Class: CW.
3. Minimum Performance Grade: 30.
4. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.

    a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

5. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
6. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.

    a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128-inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.

7. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:

    a. Cam-action sweep sash lock and keeper at meeting rails.
    b. Spring-loaded, snap-type lock at jambs.
    c. Lift handles for single-hung units.
    d. Steel or bronze operating arms.

8. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.
9. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:

    a. Glass-Fiber Mesh Fabric: 18-by-16 or 18-by-14 mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D 3656.

B. Glazing: As indicated on Drawings.

C. Finish: Match adjacent aluminum-framed storefront finish.

2.5 GLAZING

A. Glazing: Comply with Section 08 8000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 08 8000 "Glazing."

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8-inch in 10 feet; ¼-inch in 40 feet.
2. Level: 1/8-inch in 20 feet; ¼-inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to ½-inch wide, limit offset from true alignment to 1/16-inch.

b. Where surfaces are separated by reveal or protruding element from ½- to 1 inch wide, limit offset from true alignment to 1/8-inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4-inch.

4. Location: Limit variation from plane to 1/8-inch in 12 feet; 1/2-inch over total length.

END OF SECTION 08 4113

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Mechanical door hardware for swinging doors.
2. Electrified door hardware.

B. Related requirements include Section 08 1213 “Hollow Metal Frames” for door silencers provided as part of hollow-metal frames.

1.3 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into Keying Schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.

d. Requirements for access control.
e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit Door Hardware Schedule concurrent with submissions of Product Data and Shop Drawings. Coordinate submission of Door Hardware Schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in Door Hardware Schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on Floor Plans and to Door and Frame Schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Fastenings and other installation information.
e. Explanation of abbreviations, symbols, and designations contained in Door Hardware Schedule.
f. Mounting locations for door hardware.
g. List of related door devices specified in other Sections for each door and frame.

C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final Door Hardware and Keying Schedule.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A 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 who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final Door Hardware Schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: 3 years from date of Substantial Completion unless otherwise indicated below:

a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

3. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 HINGES

A. Hinges: BHMA A156.1.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Allegion plc.
b. Hager Companies.
c. McKinney Products Company; an ASSA ABLOY Group company.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in Door Hardware Schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated on Drawings.
2. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

F. Bored Locks: BHMA A156.2; Series 4000.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.

d. Hager Companies.
e. SARGENT Manufacturing Company; ASSA ABLOY.
f. Stanley Commercial Hardware; a division of Stanley Security Solutions.
g. Yale Security Inc; an ASSA ABLOY Group company.

G. Mortise Locks: BHMA A156.13; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
b. Allegion plc.
c. Best Access Systems; Stanley Security Solutions, Inc.
d. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
e. Hager Companies.
f. SARGENT Manufacturing Company; ASSA ABLOY.
g. Stanley Commercial Hardware; a division of Stanley Security Solutions.
h. Yale Security Inc; an ASSA ABLOY Group company.

2.5 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; with faceplate to suit lock and frame.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Allegion plc.
b. Hager Companies.
c. HES, Inc.; an ASSA ABLOY Group company.
d. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
e. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.6 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
b. Allegion plc.
c. Don-Jo Mfg., Inc.

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Standard Lock Cylinders: BHMA A156.5; permanent cores; face finished to match lockset.

1. Core Type: Interchangeable.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide 1 extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System: Master key or grand master key locks to Owner's existing system.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2.9 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Allegion plc.
b. DORMA USA, Inc.
c. Hager Companies.
d. SARGENT Manufacturing Company; ASSA ABLOY.
e. Stanley Commercial Hardware; a division of Stanley Security Solutions.
f. Yale Security Inc; an ASSA ABLOY Group company.

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall-Mounted Stops: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Allegion plc.
b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
c. Trimco.

2.11 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Allegion plc.
b. DORMA USA, Inc.
c. Hager Companies.
d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
e. SARGENT Manufacturing Company; ASSA ABLOY.

2.12 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Hager Companies.
b. National Guard Products, Inc.
c. Pemko Manufacturing Co.

2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in Door Hardware Schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in Door Hardware Schedule, but not fewer than the number recommended by manufacturer for application indicated or 1 hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. 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 will impede traffic.

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

G. Door Bottoms: Apply to bottom of door, forming seal with floor when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately 6 months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.7 DEMONSTRATION

A. Engage Installer to train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE – Refer to Hardware Schedule included in the Drawings.

END OF SECTION 08 7100

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes non-load-bearing steel framing systems for interior partitions.

B. Related requirements include Section 09 2900 “Gypsum Board."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either steel studs and tracks or embossed steel studs and tracks.

1. Steel Studs and Tracks:

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) ClarkDietrich.
2) MarinoWARE.
3) MBA Building Supplies.
4) MRI Steel Framing, LLC.
5) Steel Construction Systems.

b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
c. Depth: As indicated on Drawings.

2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C645 steel studs and tracks.

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) ClarkDietrich.
2) MarinoWARE.
3) MBA Building Supplies.
4) Steel Construction Systems.

b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide 1 of the following:

1. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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) ClarkDietrich.
2) MarinoWARE.
3) MBA Building Supplies.
4) Steel Construction Systems.

D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

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. ClarkDietrich.
    b. MarinoWARE.
    c. MBA Building Supplies.
    d. Steel Construction Systems.

2. Steel Construction Systems Depth: 1-1/2 inches.
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C645.

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. ClarkDietrich.
    b. MarinoWARE.
    c. MBA Building Supplies.
    d. Steel Construction Systems.

2. Minimum Base-Metal Thickness: 0.0296-inch.
3. Depth: As indicated on Drawings.

F. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 3/4-inch.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329-inch.
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double-strand of 0.048-inch-diameter wire.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 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. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install 2 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.

E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3.4 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, 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 permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Installation Tolerances: Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes interior gypsum board.

B. Related requirements include Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 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.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

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

    a. American Gypsum.
    b. CertainTeed Gypsum.
    c. Georgia-Pacific Gypsum LLC.
    d. National Gypsum Company.
    e. USG Corporation.

2. Thickness: 5/8-inch.
3. Long Edges: Tapered.

2.3 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. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. Expansion (control) joint.

2.4 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 drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033- to 0.112-inch thick.

C. Acoustical 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.

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. Grabber Construction Products.
b. Hilti, Inc.
c. Pecora Corporation.
d. Specified Technologies, Inc.
e. USG Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM 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 1 framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 square feet in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.

B. Single-Layer Application: On partitions/walls, apply gypsum panels horizontally (perpendicular to framing unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

1. Stagger abutting end joints not less than 1 framing member in alternate courses of panels.
2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
3. Install acoustic batt insulation in walls as indicated in Partition Types. Batt insulation to be fiberglass or mineral wool, fitted tightly in stud cavity.

3.4 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.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. L-Bead: Use where indicated.
3. U-Bead: Use at exposed panel edges and/or where indicated.

3.5 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 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 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 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 09 2900

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient

temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS - APC1

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.

C. Color: As indicated on Drawings.

D. Light Reflectance (LR): Not less than 0.85.

E. Ceiling Attenuation Class (CAC): Not less than 35.

F. Noise Reduction Coefficient (NRC): Not less than 0.75.

G. Edge/Joint Detail: Beveled, kerfed, and rabbeted long edges and square, butt-on short edges.

H. Thickness: 3/4-inch.

I. Modular Size: As indicated on Drawings.

J. Antimicrobial Treatment: Manufacturer's standard broad-spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM - APC1

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll-formed from cold-rolled steel sheet; pre-painted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Cast-in-place, post-installed expansion, or post-installed bonded anchors.
b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
c. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

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 B164, nickel-copper-alloy UNS No. N04400.
4. Size: Wire diameter sufficient for its stress at 3 times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8-inch 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. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

PART 3 - EXECUTION

3.1 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.

3.2 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 unless otherwise indicated and comply with layout shown on Reflected Ceiling Plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

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, counter-splaying, 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 3 tight turns. Connect hangers directly to structure 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, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of 4 tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

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 o.c. and not more than 3 inches from ends. 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 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.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8-inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8-inch in 12 feet, non-cumulative.

3.5 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE - RB1

A. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location: Style B, Cove.

B. Thickness: 0.125 inch.

C. Height: As indicated on Drawings.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Job formed.

F. Inside Corners: Job formed.

G. Colors: As indicated on Drawings.

2.2 RUBBER MOLDING ACCESSORY

A. Description: Rubber transition strips.

B. Profile and Dimensions: As indicated on Drawings.

C. Locations: Provide rubber molding accessories in areas indicated on Drawings.

D. Colors and Patterns: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they shall be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

   a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

   a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes rubber sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: For each exposed product and for each color, texture, and pattern specified, in manufacturer's standard size, but not less than 6-by-9-inch sections.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet-flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet-flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F. Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 85 degrees F in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45-W/sq. cm.

2.2 RUBBER SHEET FLOORING - RS1

A. Product Standard: ASTM F1860.

1. Type: Type I, homogeneous rubber sheet floor covering with backing.
2. Wear-Layer Thickness: As standard with manufacturer.
3. Overall Thickness: 0.08-inch.
4. Interlayer Material: None.
5. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D2240.

B. Wearing Surface: Smooth.

C. Sheet Width: As standard with manufacturer.

D. Seamless-Installation Method: Heat welded.

E. Colors and Patterns: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Colors: As selected by Architect from manufacturer's full range.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

I. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches or as indicated on Drawings up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 6516

SECTION 09 6623 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes the Following: Decorative epoxy resin flooring.

B. Related Sections Include the Following: Division 03 Section “Concrete.”

1.3 SUBMITTALS

A. Equals must be submitted to the Architect no later than 10 calendar days prior to the Bid date for verification and approval.

B. Product Data: For each type of product specified. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available for each resinous flooring system indicated.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Material Certificates: In lieu of material test reports, when permitted by Architect, signed by manufacturers certifying that materials furnished comply with requirements.

F. Maintenance Data: For resinous flooring to include in the maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced company with a minimum of 5 years’ experience or who has installed at least 10 resinous flooring projects similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through 1 source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring application and for not less than 48 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS – CORRIDOR FLOORS

A. Available Manufacturers: Basis of Design Dur-A-Flex or equal product by manufacturers below. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advantage Chemical Coatings, LLC: Advacoat ACC 75.
2. Degussa Building Systems; Selby/Ucrete: Selbatwede 41.
3. Dex-O-Tex; Crossfield Products Corporation: Deco-Flor-Broadcast.
4. Floorock: FloorQuartz BC.
5. Milamar Coatings: PolyMax PM-DHD.
6. Sika Corporation Industrial Flooring Division: Quartizite 6000, Solvent Free.
7. Stonhard:. StoneShield SLT Quartz
8. Tennant Company: Eco-DQS Quartz.

B. Materials: Resinous Flooring: Resinous floor surfacing system consisting of primer; body coat(s), including resin, hardener, aggregates, and colorants, if any; and sealing or finish coat(s).

1. Physical Properties: Resinous Flooring shall comply with the following minimum test standards:

a. Impact Strength, in lbs., ASTM 2794 60
b. Compressive Strength, ASTM C579 ..... 12,900 psi
c. Compressive Strength, ASTM C695 ..... 12,000 psi
d. Compressive Strength, ASTM C109 ..... 10,200 psi
e. Tensile Strength, ASTM D638 ..... 1,160 psi
f. Flexural Strength, ASTM D790 ..... 4,600 psi
g. Surface Flammability, ASTM E162.....Flame-spread index: 9.29
h. Rate of Burning, ASTM D635..... Self extinguishing
i. Indentation, MIL D 24613, 24 hrs. residual 0.0008
j. Impact Resistance, MIL D 24613 ..... No chipping, cracking or delamination
k. Fire Resistance, MIL D 24613.....Fire Retardant

l. Slip Resistance Properties, MIL D 3134 or MIL D 24613 .....Static Friction 0.6
m. Abrasion Resistance, CS17 Wheel 1,000 gm load,1,000 cycles.....<0.078
n. Coefficient of Friction, ASTM D2047 ..... Dry:>0.07; Wet:>1.20

C. Chemical Resistance: In accordance with ASTM D1308 resinous flooring system shall withstand exposure up to 7 days at 72 degrees F for the following chemicals against the following reagents and concentrations noted for 7 days:

1. Dilute mineral acids, including hydrochloric (<30 percent), phosphoric (<20 percent), and sulfuric (<30 percent).
2. Alkalis, including potassium hydroxide to a 50 percent concentration.
3. Some dilute organic acids such as acetic (30 percent), formic, citric, and uric.
4. Fats, oils, or sugars.
5. Mineral oil, diesel fuel, kerosene, and gasoline.
6. Some organic solvents, including aliphatic hydrocarbons.

D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

C. Allow concrete substrate to cure a minimum of 30 days.

D. Check for Moisture: Concrete must be dry before application of flooring materials. Following manufacturer’s written procedure for testing concrete.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring by shot blasting or diamond grinding floor.

a. Comply with ASTM C811 requirements, unless manufacturer’s written instructions are more stringent.
b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.3 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply 2 coats of finish in color selected at manufacturer's recommended rate to achieve desired finish and texture selected.

1. Broadcast aggregates/flakes and, after resin is cured, remove excess aggregates/flakes to provide surface texture indicated.
2. Provide medium non-skid finish.

D. Total floor system shall have a minimum thickness of 3/16-inch.

3.4 CLEANING AND PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

B. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each Project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 6623

SECTION 09 6813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:

1. Section 02 4119 "Selective Demolition" for removing existing floor coverings.
2. Section 09 6513 "Resilient Base and Accessories" and Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 square yards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

1.8 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. Excessive surface wear, edge raveling, and zippering.
b. More than 10 percent loss of backing resiliency
c. More than 15 percent loss of face fiber.
d. Delamination.

3. Warranty Period: Lifetime Limited from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE - CPT1

A. Color: As indicated on Drawings.

B. Pattern: As indicated on Drawings.

C. Fiber Content: 100 percent Nylon 6.

D. Fiber Type: Dynex SD Nylon.

E. Pile Characteristic: Level-loop pile.

F. Tuft Density: 125.4 tufts/square inch.

G. Pile Thickness: 0.187-inch for finished carpet tile.

H. Stitches: 9.8 per inch.

I. Gage: 5/64 ends per inch.

J. Dye Method: 100 percent solution dyed.

K. Primary Backing/Backcoating: Manufacturer's standard composite materials.

L. Secondary Backing: Manufacturer's standard material.

M. Backing System: Ethos Omnicoat Backing.

N. Size: As indicated on Drawings.

O. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

P. Performance Characteristics:

1. Colorfastness to Light: Not less than 4 after 100 hours AFU (AATCC fading units) according to AATCC 16, Option E.
2. Electrostatic Propensity: Less than 3.0 kV according to AATCC 134.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch wide or wider, and protrusions more than 1/32-inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer and as indicated on Drawings.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and iron.
2. Galvanized metal.
3. Aluminum (not anodized or otherwise coated).
4. Gypsum board.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in Schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide 1 of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer**.**

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in Painting Schedules may be omitted on items that are factory-primed or factory-finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
b. Intermediate Coat: Latex, interior, institutional low-odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low-odor/VOC, flat (MPI Gloss Level 1), MPI #143.
d. Topcoat: Latex, interior, institutional low-odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

B. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.4G:

a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
b. Intermediate Coat: Latex, interior, institutional low-odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low-odor/VOC, flat (MPI Gloss Level 1), MPI #143.
d. Topcoat: Latex, interior, institutional low-odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

C. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:

a. Prime Coat: Primer sealer, interior, institutional low-odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low-odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low-odor/VOC (MPI Gloss Level 3), MPI #145.

END OF SECTION 09 9123

SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes manually operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Samples: For each exposed product and for each color and texture specified, 10 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating

range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 pounds or for shades as recommended by manufacturer, whichever criterion is more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade or left side of interior face of shade as needed.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to 3 inline rollers into a multiband shade that is operated by 1 roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As indicated on Drawings.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

    a. Shape: L-shaped.
    b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: PVC-coated polyester.
3. Weave: Basketweave.
4. Roll Width: 63 inches or 98 inches.
5. Orientation on Shadeband: Up the bolt or railroaded.
6. Openness Factor: As indicated on Drawings.
7. Color: As indicated on Drawings.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4-inch per side or 1/2-inch total, plus or minus 1/8-inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4-inch, plus or minus 1/8-inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, 1 partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 2413

SECTION 12 3553.16 - PLASTIC-LAMINATE-CLAD LABORATORY CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad laboratory casework.
2. Utility-space framing at backs of base cabinets.
3. Filler and closure panels.
4. Laboratory countertops.
5. Shelves.
6. Laboratory sinks.
7. Laboratory accessories.
8. Water, laboratory gas, and electrical service fittings.

B. Related Requirements:

1. Section 09 2216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring laboratory casework.
2. Section 09 6513 "Resilient Base and Accessories" for resilient base applied to laboratory casework.

1.3 DEFINITIONS

A. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets are defined as "exposed" except ends are defined as "concealed" where installed directly against and completely concealed by walls or other cabinets.

C. Semi-exposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cases 78 inches or more above floor and bottoms of cabinets more than 24 inches, but less than 48 inches above floor, are defined as "semi-exposed."

1.4 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

B. Coordinate installation of laboratory casework with installation of laboratory equipment.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Show fabrication details, including types and locations of hardware.
4. Indicate locations and types of service fittings.
5. Include details of utility spaces showing supports for conduits and piping.
6. Include details of exposed conduits, if required, for service fittings.
7. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and laboratory equipment.
8. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples: For plastic laminate.

E. Samples for Verification: For each type of casework and countertop-material finish, in manufacturer's standard sizes.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For countertop surface material, based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface material with requirements specified for chemical and physical resistance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet-work are complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where laboratory casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 CASEWORK MANUFACTURERS

A. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

1. Obtain countertops and sinks from single manufacturer.

2.2 CASEWORK, GENERAL

A. Casework Product Standard: Comply with SEFA 8 PL, "Recommended Practices for Plastic Laminate Laboratory Grade Furniture, Casework, Shelving and Tables."

B. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction and FM Approvals.

2.3 PLASTIC-LAMINATE CABINETS

A. Grain Direction for Wood Grain Plastic Laminate or Patterned Plastic Laminate:

1. Doors: Vertical with continuous vertical matching.
2. Drawer Fronts: Vertical with continuous vertical matching.
3. Face Frame Members: Lengthwise.
4. End Panels: Vertical.
5. Bottoms and Tops of Units: Side to side.
6. Knee Space Panels: Vertical.
7. Aprons: Vertical.

B. Exposed Materials:

1. Plastic-Laminate Grade: HGS or VGS as applicable.

a. Colors and Patterns: As indicated on Drawings.

2. Edgebanding: PVC.

a. PVC Edgebanding Color: As selected by Architect from casework manufacturer's full range.

C. Semi-exposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semi-exposed surfaces unless otherwise indicated.

a. Colors and Patterns: As indicated on Drawings.
b. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

2. Thermoset Decorative Panels: Provide thermoset decorative panels for semi-exposed surfaces unless otherwise indicated.

a. Colors and Patterns: As selected by Architect from manufacturer's full range.
b. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

3. Plywood: Hardwood plywood. Grade B faces and Grade J crossbands. Provide backs of same species as faces.

D. Concealed Materials:

1. Plywood: Hardwood plywood.
2. Plastic Laminate: Grade BKL.
3. MDF.

2.4 PLASTIC-LAMINATE CABINET MATERIALS

A. Hardwood Plywood: Grade A/C.

B. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

C. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Formica Corporation.
b. Wilsonart LLC.

D. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.

E. Thermoset Decorative Panels: MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Edgebanding for Thermoset Decorative Panels: PVC or polyester edgebanding matching thermoset decorative panels.

2.5 CABINET HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, Type B01602, self-closing. Provide 2 for doors 48 inches high or less and 3 for doors more than 48 inches high.

1. Degrees of Opening: 135.

C. Hinged-Door and Drawer Pulls: Solid-aluminum, stainless-steel, or chrome-plated-brass, back-mounted pulls. Provide 2 pulls for drawers more than 24 inches wide.

1. Design: Wire pulls.
2. Overall Size: 1-1/4 by 4-1/2 inches.

D. Door Catches: Dual, self-aligning, permanent magnet catches. Provide 2 catches on doors more than 48 inches high.

E. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with ANSI/BHMA A156.9, Type B05091.

1. Standard Duty (Grade 1): Full-extension type, with polymer rollers.
2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-extension, ball-bearing type.

F. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches, attached with screws or rivets. Provide on drawers.

G. Locks: Cam type, brass with chrome-plated finish; complying with ANSI/BHMA A156.11, Type E07281 or Type E07261.

1. Lock Locations: Provide on drawers and doors.
2. Keying: Key each lock separately.

a. Masterkey for up to 225 key changes.

3. Key Quantity: Minimum of 2 keys per lock.
4. Master Key System: Key locks shall be operable by master key.

a. Master Keys: Provide 2.

H. Adjustable Shelf Supports: ANSI/BHMA A156.9, powder-coated steel standards, mortise type, and shelf rests, Type B04071 and Type B04091.

2.6 COUNTERTOP AND SINK MATERIALS

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

a. Durcon; a Wilsonart Company.
b. Prime Industries, Inc.

2. Physical Properties:

a. Flexural Strength: Not less than 10,000 psi.
b. Modulus of Elasticity: Not less than 2,000,000 psi.
c. Hardness (Rockwell M): Not less than 100.
d. Water Absorption (24 Hours): Not more than 0.02-percent.
e. Heat Distortion Point: Not less than 260 degrees F.

3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

4. Color: As indicated on Drawings.

2.7 CABINET FABRICATION

A. Construction: Provide plastic-laminate laboratory casework of the following minimum construction:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch-thick plywood.
2. Shelves: 3/4-inch-thick plywood.
3. Exposed Backs of Cabinets: 1/2-inch-thick MDF.
4. Backs of Cabinets: 1/4-inch-thick hardboard or 1/4-inch-thick, veneer-core hardwood plywood dadoed into sides, bottoms, and tops where not exposed unless otherwise indicated.
5. Drawer Fronts: 3/4-inch-thick MDF or plywood.
6. Drawer Sides and Backs: 1/2-inch-thick veneer-core MDF, with glued dovetail or multiple-dowel joints.
7. Drawer Bottoms: 1/4-inch-thick MDF glued and dadoed into front, back, and sides of drawers.

    a. Use 1/2-inch-thick material for drawers more than 24 inches wide.

8. Drawer Bodies: Steel drawer pans formed from 0.036-inch-thick metal, metallic phosphate treated, and finished with manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry-film thickness of 1 mil for topcoat and 2 mils for system.
9. Doors: 3/4-inch thick, with MDF cores.

    a. Provide solid-wood stiles and rails.

B. Utility-Space Framing: Steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105-inch nominal thickness, that are connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding channel material into rectangular frames instead of using U-shaped brackets.

C. Removable Backs: Provide backs that can be removed from within cabinets at utility spaces.

D. Filler and Closure Panels: Provide where indicated and as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as adjacent exposed casework surfaces unless otherwise indicated.

1. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed.
2. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
3. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.

2.8 COUNTERTOPS AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.

2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.

C. Plastic-Laminate Shelves:

1. Plastic-Laminate Shelves: Plastic laminate shop bonded to both faces and edges of core. Sand surfaces to which plastic laminate is to be bonded.

a. Shelf Core: Plywood.
b. Core Thickness: 3/4-inch.
c. Plastic-Laminate Grade: HGS.

D. Epoxy Countertops and Sinks:

1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.

a. Flat Configuration: 1 inch thick with continuous drip groove on underside 1/2-inch from overhang edge.

1) Edges and Corners: Rounded.
2) Backsplash: Applied.

b. Construction: Uniform throughout full thickness.

2. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.

a. Provide with polypropylene strainers and tailpieces.
b. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
c. Provide sinks for underside installation with manufacturer's recommended adjustable support system for table- and cabinet-type installations.

2.9 WATER AND LABORATORY GAS SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:

1. Broen A/S.
2. Chicago Faucets; Geberit Company.
3. WaterSaver Faucet Co.

B. Service Fittings: Provide units that comply with SEFA 7, "Recommended Practices for Fixtures." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.

D. Finish: Chromium plated.

1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by Architect.

E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig.

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
3. Self-Closing Valves: Provide self-closing valves where indicated.

F. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."

G. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.

H. Handles: Provide 3- or 4-arm, forged-brass handles for valves unless otherwise indicated.

1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CASEWORK

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true in line; shim as required using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16-inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/8-inch in 10 feet.
3. Variation of Faces of Casework from a True Plane: 1/8-inch in 10 feet.
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32-inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16-inch.

B. Utility-Space Framing: Secure to floor with 2 fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches o.c.

E. Install hardware uniformly and precisely.

F. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

C. Fastening:

1. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
2. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8-inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide holes and cutouts required for service fittings.

E. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

F. Dress joints smooth, remove surface scratches, and clean entire surface.

3.4 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.

B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

C. Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive, and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

3.5 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in other Sections for installing water fittings.

B. Install fittings in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.6 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

END OF SECTION 12 3553.16

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Plumbing Specialties” for water distribution piping specialties.

1.2 SUMMARY

A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Distribution Piping: 125 psig (860 kPa).

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: For pipe, tube, fittings, and couplings.

C. Water Samples: Specified in "Cleaning" Article in Part 3.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

C. Comply with Federal Lead-Free requirements including NSF/ANSI 61 and NSF/ANSI 372.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBING

A. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.3 VALVES

A. Refer to Division 23 Section "Valves" for balancing and drain valves.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 (DN 40) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

3.2 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller.
2. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
3. Drain Duty: Hose-end drain valves.

3.3 PIPING INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install water-pressure regulators downstream from shutoff valves. Refer to Division 22 Section "Plumbing Specialties" for water-pressure regulators.

C. Install aboveground domestic water piping level with 0.25 percent slope downward toward drain and plumb.

D. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

E. Perform the following steps before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

F. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

G. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.

H. Energize pumps and verify proper operation.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

A. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller.

B. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

C. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Division 22 Section "Plumbing Specialties" for calibrated balancing valves.

3.6 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 23 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 23 Section "Hangers and Supports."

C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Adjust calibrated balancing valves to flows indicated.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 1116

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 22 and 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: For pipe, tube, fittings, and couplings.

C. Shop Drawings: For sovent drainage system, include plans, elevations, sections, and details.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 CAST-IRON SOIL PIPING

A. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Cast Iron Pipe Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AB&I Foundry.
b. Charlotte Pipe and Foundry Company.
c. Tyler Pipe; a subsidiary of McWane Inc.

2. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.

1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch- (76-mm-) wide shield with 4 bands.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Use NPS 1-1/2 (DN 40) hubless, cast-iron soil piping and one of the following:

a. Couplings: Heavy-duty, Type 304, stainless steel.

2. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:

a. Couplings: Heavy-duty, Type 304, stainless steel.

3.2 PIPING INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or away from vent stack.

3.3 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 23 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Division 23 Section "Hangers and Supports."

C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch rod.
2. NPS 3 (DN 80): 60 inches with 1/2-inch rod.
3. NPS 4 (DN 100): 60 inches with 5/8-inch rod.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 1316

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 22 and 23 Sections contain requirements that relate to this Section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Valves” for general-duty valves used as supply stops.
4. “Plumbing Specialties” for backflow preventers and other specialties not specified in this Section.
5. “Domestic Water Piping” for water distribution within building.
6. “Sanitary Waste and Vent Piping” for waste and vent piping within building.

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

C. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

D. Maintenance Data: For plumbing fixtures and components to include in the Operation and Maintenance Manuals specified in Division 23 Section “Basic Mechanical Requirements.”

1.4 QUALITY ASSURANCE

A. Comply with locally adopted edition of “Uniform Plumbing Code” for plumbing materials, components, and installation.

B. Regulatory Requirements: Comply with requirements of ICC A117.1, "Accessible and Usable Buildings and Facilities" about plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements of Public Law 102-486, "Energy Policy Act," regarding water flow rate and water consumption of plumbing fixtures.

D. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

E. 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.

F. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures.

G. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

H. Comply with Federal Lead Free requirements including NSF/ANSI 61 and NSF/ANSI 372.

I. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

1.5 PROJECT CONDITIONS

A. Coordinate roughing-in and final fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

1.6 EXTRA MATERIALS

A. Deliver extra materials to Owner and provide copy of receipt to Engineer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Quantity shall be 10 percent of amount installed, but not less than one, unless noted otherwise.

1. Faucet Washers and O-Rings
2. Faucet Cartridges and O-Rings
3. Faucet, Laminar-Flow Fittings
4. Faucet, Flow-Control Fittings
5. Filter Cartridges
6. Items for Sensor - Operated Faucets and Devices

    a. Power transformers.
    b. Sensor modules.
    c. Solenoid valves.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products in each category, by one of the following listed for that category:

1. Lavatories:

   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Briggs Industries, Inc.
   d. Crane Plumbing/Fiat Products.
   e. Gerber Plumbing Fixtures Corp.
   f. Kohler Co.
   g. Mansfield Plumbing Products, Inc.
   h. Universal-Rundle Corp.
   i. U.S. Industries, Eljer Plumbingware Div.
   j. Sloan

2. Sinks:

   a. American Standard, Inc.
   b. Briggs Industries, Inc.
   c. Crane Plumbing/Fiat Products.
   d. Elkay Manufacturing Co.
   e. Just Manufacturing Co.
   f. Kohler Co.
   g. Moen Group; Stanadyne Corp.
   h. Universal-Rundle Corp.
   i. U.S. Industries, Eljer Plumbingware Div.
   j. Sloan

3. Emergency Equipment:

   a. Bradley Corp.
   b. Guardian Equipment.
   c. Haws Drinking Faucet Co.
   d. Speakman Co.
   e. Stingray

4. Cast-Brass Faucets:

   a. American Standard, Inc.
   b. Briggs Industries, Inc.
   c. Cambridge Brass; Div. of Masco Corp.
   d. Chicago Faucet Co.
   e. Crane Plumbing/Fiat Products.
   f. Delta Faucet Co.; Div. of Masco Corp.
   g. Elkay Manufacturing Co.

h. Gerber Plumbing Fixtures Corp.
i. Grohe America, Inc.
j. Kohler Co.
k. Moen Group; Stanadyne Corp.
l. Royal Brass Mfg. Co.
m. Speakman Co.
n. Symmons Industries, Inc.
o. T&S Brass and Bronze Works, Inc.
p. U.S. Industries, Eljer Plumbingware Div.

5. Thermostatic Mixing Valve Bath/Shower Faucets:

a. Acorn Engineering Co.
b. Bradley Corp.
c. Grohe America, Inc.
d. Lawler
e. Leonard Valve Co.
f. Powers Process Controls; A Unit of Mark Controls Corp.
g. Symmons Industries, Inc.
h. T&S Brass and Bronze Works, Inc.

6. Sensor-Operated Faucets and Devices:

a. Acorn Engineering Co.
b. Bradley Corp.
c. Cambridge Brass; Div. of Masco Corp.
d. Coyne & Delaney Co.
e. Sloan Valve Co.
f. Speakman Co.

7. Miscellaneous Fittings (Except Faucets):

a. Chicago Faucet Co.
b. Crane Plumbing/Fiat Products.
c. Kohler Co.
d. Royal Brass Mfg. Co.
e. T&S Brass and Bronze Works, Inc.
f. U.S. Industries, Eljer Plumbingware Div.

8. Supports:

a. Josam Co.
b. Smith (Jay R.) Mfg. Co.
c. Wade Div.; Tyler Pipe.
d. Watts Drainage Products.
e. Zurn Industries, Inc.; Hydromechanics Div.

9. Handicap Trap and Valve Insulation Kits:

a. Brocar Products, Inc.
b. McGuire Mfgr. Co. Inc. - Prowrap
c. Truebro, Inc.

2.2 PLUMBING FIXTURE STANDARDS

A. Comply with applicable standards below and other requirements specified.

1. Emergency Equipment: ANSI Z358.1.
2. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
3. Hand Sinks: NSF 2 construction.
4. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.

2.3 LAVATORY/SINK FAUCET STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; cast brass bodies; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Supply and Drain Fittings: ASME A112.18.1M.

2.4 MISCELLANEOUS FITTING STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
5. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

2.5 MISCELLANEOUS COMPONENT STANDARDS

A. Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.

1. Floor Drains: ASME A112.21.1M.
2. Hose-Coupling Threads: ASME B1.20.7.

3. Off-Floor Fixture Supports: ASME A112.6.1M.
4. Pipe Threads: ASME B1.20.1.
5. Supply and Drain Protective Shielding Guards: ICC A117.1

2.6 PLUMBING FIXTURES, GENERAL

A. Provide plumbing fixtures and trim, fittings, faucets, other components, and supports as specified in the "Plumbing Fixture Schedule" and other parts of this section. "PFS" is located at end of this section or on the plans.

2.7 FITTINGS

A. Fittings General: Unless otherwise specified, provide fittings fabricated of brass, with a polished chrome plated finish. Chrome stops with plastic turn knobs will not be accepted.

B. Lavatory Supplies and Stops; Loose-key angle stop, having 1/2-inch NPS inlet with wall flange and 3/8-inch by 12-inch flexible tubing riser outlet.

C. Lavatory Supplies and Stops: Wheel handle angle stop, having 1/2-inch NPS inlet with wall flange and 3/8-inch by 12-inch flexible tubing riser outlet.

D. Traps: Cast-brass, 1-1/2-inch NPS adjustable P-trap with cleanout, 17-gage tubular waste to wall, and wall flange.

E. Escutcheons: Polished chrome-plated, sheet steel wall flange with friction clips.

2.8 PLUMBING FIXTURE SUPPORTS

A. Supports: Categories and types as required for wall-hanging fixtures specified, and wall reinforcement.

B. Support categories are:

1. Chair Carriers: Floor mount supported with rectangular steel uprights, block bases, hanger and bearing plates, and adjustable supporting rods for wall-hanging fixtures.
2. Wall mounted plate type carriers will not be acceptable.

2.9 HANDICAP TRAP AND VALVE INSULATION KITS

A. Handicap trap and valve insulation kit: Provide insulation kit at lavatories, sinks and other fixtures designated as handicap accessible fixtures.

1. Material: Molded closed cell vinyl.
2. Thickness: Minimum wall thickness of 1/8".
3. Conductivity: K=1.02 Btu-in/hr-ft2-□F (minimum).
4. Burning Characteristics: Self extinguished 5 sec. (ATB) 10mm (AEB).
5. Fasteners: Nylon ties.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings.

B. Install supports for plumbing fixtures in accordance with categories indicated and of type required:

1. Carriers for following fixtures:

    a. Fixtures supported from wall construction.

2. Chair carriers for the following fixtures:

    a. Wall-hanging lavatories and sinks.

3. Provide reinforcement where required for floor-mounted fixtures which require securing to wall.
4. Fabricate reinforcement from 2-by-4-inch or 2-by-6-inch fire-retardant-treated-wood blocking between studs or 1/4-by-6-inch steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.

C. Include fitting insulation kits for accessible fixtures according to the following:

1. Lavatories: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
2. Sinks: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
3. Other Fixtures: Cover exposed fittings below fixture.

3.3 PLUMBING FIXTURE INSTALLATION

A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

C. Install counter-mounting fixtures in and attached to casework.

D. Install wall-hanging fixtures with tubular waste piping attached to supports.

E. Install water supply piping with individual stop valve in accessible location to each fixture. Attach supplies to supports or substrate within pipe spaces behind fixtures.

1. Exception: Omit stop valves on supplies to emergency equipment, except when permitted by authorities having jurisdiction. When permitted, install valve chained and locked in OPEN position.

F. Install faucets in accordance with accepted standard practice (right hand cold, left hand hot, both levers operate towards the user, etc.).

G. Provide access doors as required for concealed items such as shock arrestors, transformers, solenoid valves, or any other items which require access or maintenance.

H. Install traps on fixture outlets.

1. Exception: Omit traps on fixtures having integral traps.
2. Exception: Omit traps on indirect wastes, except where otherwise indicated.

I. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division 23 Section “Basic Mechanical Materials and Methods” for escutcheons.

J. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.

F. Electrical: Refer to Section 23 0510 “Basic Mechanical Requirements” for electrical connections to mechanical equipment.

3.5 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust sensor operated faucets and valves, and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets having controls, to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

3.7 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.8 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

END OF SECTION 22 4000

SECTION 23 0500- BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements specified in Division 23 Section “Basic Mechanical Requirements” apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections and for application with mechanical installations.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment bases.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Equipment nameplate data requirements.
7. Mechanical identification.
8. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Mechanical Identification."
9. Nonshrink grout for equipment installations.
10. Field-fabricated metal and wood equipment supports.
11. Installation requirements common to equipment specification sections.
12. Mechanical demolition.
13. Cutting and patching.
14. Touchup painting and finishing.
15. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

B. Pipe and pipe fitting materials are specified in Division 23 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Coordination Drawings: For access panel and door locations.

E. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

F. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

G. Product data for the following specialties:

1. Mechanical sleeve seals.
2. Access panels and doors.
3. Joint Sealers.

H. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

I. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of work. Include coordination for shut-off of services, and details for dust and noise control.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

C. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code--Steel."

D. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

E. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch frame manufacturer listed in the UL "Building Materials Directory" for rating shown.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.

F. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.8 PROJECT CONDITIONS

A. Conditions Affecting Selective Demolition: The following project conditions apply:

1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
2. Locate, identify, and protect services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

a. Capitol Manufacturing Co.
b. Central Plastics Co.
c. Eclipse, Inc.; Rockford-Eclipse Div.
d. Epco Sales Inc.
e. Hart Industries International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

a. Capitol Manufacturing Co.
b. Central Plastics Co.
c. Epco Sales Inc.
d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

a. Calpico, Inc.
b. Central Plastics Co.

4. Dielectric Couplings:

    a. Calpico, Inc.
    b. Lochinvar Corp.

5. Dielectric Nipples:

    a. Grinnell Corp.; Grinnell Supply Sales Co.
    b. Perfection Corp.
    c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

    a. ANAMET Industrial, Inc.
    b. Central Sprink, Inc.
    c. Flexicraft Industries.
    d. Flex-Weld, Inc.
    e. Grinnell Corp.; Grinnell Supply Sales Co.
    f. Hyspan Precision Products, Inc.
    g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
    h. Mercer Rubber Co.
    i. Metraflex Co.
    j. Proco Products, Inc.
    k. Uniflex, Inc.

7. Rubber, Flexible Connectors:

    a. General Rubber Corp.
    b. Mercer Rubber Co.
    c. Metraflex Co.
    d. Proco Products, Inc.
    e. Red Valve Co., Inc.
    f. Uniflex, Inc.

8. Mechanical Sleeve Seals:

    a. Calpico, Inc.
    b. Metraflex Co.
    c. Thunderline/Link-Seal.

9. Access Doors:

    a. Bar-Co., Inc.
    b. J.L. Industries
    c. Karp Associates, Inc.
    d. Milcor Div. Inryco, Inc.
    e. Nystrom, Inc.

10. Elastomeric Joint Sealers:

    a. One-Part, Nonacid-Curing, Silicone Sealants:

        1) "Chem-Calk N-Cure 2000," Bostic Construction Products Div.
        2) "864," Pecora Corp.
        3) "Rhodorsil 5C," Rhone-Poulenc, Inc.
        4) "Spectrum 1," Tremco, Inc.
        5) "Spectrum 2," Tremco, Inc.

    b. One-Part, Mildew-Resistant, Silicone Sealant:

        1) "863 #345 White," Pecora Corp.
        2) "Rhodorsil 6B White," Rhone-Poulenc, Inc.
        3) "Proglaze White," Tremco Corp.
        4) "OmniPlus," Sonneborn Building Products Div.

11. Fire-Resistant Joint Sealers:

    a. STI (Specified Technologies, Inc.)
    b. 3M Fire Protection Products
    c. IPC (International Protective Coatings Corp.)
    d. Hilti FS-ONE.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 Inch (3.2 mm) maximum thickness, unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 Inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. ASME B16.20 for grooved, ring-joint, steel flanges.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Lead Free-Antimony Free: Tin (approximately 95.5 percent), copper (approximately 4 percent) and silver (approximately .5 percent).
2. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
3. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
4. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
5. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
6. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

I. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725 kPa) minimum working pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300-psig (1035 or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150 or 300-psig (1035 or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2-Inch NPS (DN50) and Smalller: Threaded.
2. 2-½-Inch NPS (DN65) and Larger: Flanged.
3. Option for 2-½ Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig (860-kPa) minimum working-pressure rating at 220 deg F (104 deg C). Units may be straight or elbow type, unless otherwise indicated.

2.6 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

a. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

a. Finish: Polished chrome-plate.

2.7 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4 inch- (30-mm-) high letters for ductwork and not less than 3/4-inch- (19-mm-) high letters for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.

F. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:

1. Green: Cold air.
2. Yellow: Hot air.
3. Yellow/Green or Green: Supply air.
4. Blue: Exhaust, outside, return, and mixed air.

5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
6. Nomenclature: Include the following:

    a. Direction of airflow.
    b. Duct service.
    c. Duct origin.
    d. Duct destination.
    e. Design cubic feet per minute (liters per second).

G. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
5. Thickness: 1/8 inch (3.2 mm), unless otherwise indicated.
6. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) long; 1/8 inch (3.2 mm) for larger units.
7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any criteria above.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

8. Size: Approximate 2-½ by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-½ by 6 inches (115 by 150 mm) for equipment.

I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-Mpa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.9 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Flush, screwdriver-operated cam locks.

2.10 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

D. Fire-Resistant Joint Sealers: Hilti FS-ONE sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE removable sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch (6.4 mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
    b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
    c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

        1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
5. Soldered Joints: Construct joints according to CDA's "Copper Tube Handbook."
6. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

8. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
9. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Install flanges, in piping 2-½ inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Engineer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
    c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
    d. At access doors, manholes, and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced at maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
    g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), ½-inch- (12.7-mm-) high lettering for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet (15 m).

D. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 23 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.9 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.10 PREPARATION AND APPLICATION OF JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

C. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

D. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

E. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.11 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

C. Install access doors where required for access to any equipment which becomes concealed by other construction. Provide access door of adequate size to maintain and replace concealed equipment.

END OF SECTION 23 0500

SECTION 23 0510 - BASIC MECHANICAL REQUIREMENTS

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 this and the other sections of Division 23.

B. Related Sections: The following Division 23 sections contain requirements that relate to this section:

1. “Basic Mechanical Materials and Methods,” for materials and methods common to the remainder of Division 23, plus general related specifications including:

a. Access to mechanical installations.
b. Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Mechanical installations.
7. Cutting and patching.
8. Temporary heating, ventilating and air conditioning.
9. Substitutions.

1.3 QUALITY ASSURANCE

A. Comply with IBC “International Building Code” for plumbing and mechanical materials, components, and installations.

B. Comply with IPC “International Plumbing Code” for plumbing materials, components, and installations.

C. Comply with IMC “International Mechanical Code” for mechanical materials, components, and installations.

D. NFPA Compliance: Components and installation shall comply with the following where applicable:

1. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
2. NFPA 101 - Life Safety Code.

1.4 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section “Submittals.”

1.5 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 Section “Project Coordination,” to a scale of 1/4”=1'-0” or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:

    a. Planned piping layout, including valve and specialty locations, and valve stem movement.
    b. Planned duct systems layout, including elbow radii and duct accessories.
    c. Clearances for installing and maintaining insulation.
    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    e. Equipment connections and support details.
    f. Exterior wall and foundation penetrations.
    g. Fire-rated wall and floor penetrations.
    h. Sizes and location of required concrete pads and bases.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.6 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section “Project Closeout.” In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 23 Section “Mechanical Identification.” Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Prepare three (3) bound Operation and Maintenance Manuals in accordance with Division 1 Section “Project Closeout.” In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, complete nomenclature and commercial numbers of replacement parts and complete parts listing with part name and number.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Reviewed shop drawings and submittals.
6. Record of spare parts provided to Owner with a signature of receipt by Owner's representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products in factory-fabricated type containers or wrappings which properly protect product from damage.

C. Store products indoors in clean, dry space in original containers. Protect products from weather, construction traffic and debris. When necessary to store outdoors, take similar precautions and store above grade and enclose with waterproof covering.

D. Handle products carefully to prevent physical damage. Do not install damaged products; replace damaged products with new.

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment and material provided shall be “lead paint free” and asbestos free.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with reviewed submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
11. Install access panels or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 23 Section “Basic Mechanical Materials and Methods.”
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 EQUIPMENT ELECTRICAL CONNECTIONS

A. Electrical: Conform to applicable requirements in Division 26 Sections.

B. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer’s published torque tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

C. Provide all accessories required for complete installation of equipment provided in Division 23 Sections. Mount accessories in appropriate locations to insure access and proper operation. Accessories include equipment control panels, solenoid valves, aquastats, flow switches and similar devices.

D. Arrange for the project electrical contractor to install all control wiring in conduit associated with any accessories provided in Division 23 Sections. Mechanical contractor is responsible for the cost of the electrical installation and for providing all equipment control wiring diagrams to the electrical contractor to insure proper connections. Control diagrams shall clearly identify factory-installed wiring and field-installed wiring. In the absence of a temperature control contractor, the mechanical contractor shall include any wiring associated with temperature control devices with the wiring to be installed by the electrical contractor.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section “Cutting and Patching.” In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
   f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

2. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.5 SUBSTITUTIONS

A. General: All changes and additional work required by this Contractor or any other Contractor because of a substitution of an equivalent piece of equipment by this Contractor shall be the responsibility of this Contractor. Substitutions will only be considered when the quality of the product is maintained, and it is advantageous to the Owner to consider.

B. Requests for approval to bid equipment by a manufacturer not listed in these specifications must be received by A/E, in written form, a minimum of ten (10) calendar days prior to bid date.

3.6 CLEANING

A. All equipment and installed materials shall be cleaned inside and outside. All construction dust and loose materials shall be removed. Any printed information attached to the equipment shall be removed and included in the Operation and Maintenance Manuals. Equipment nameplates shall NOT be removed. Any scratched paint surfaces shall be repaired with manufacturer's touch-up paint.

END OF SECTION 23 0510

SECTION 23 0513 - MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.2 SUMMARY

A. This Section includes basic requirements for factory-installed and field-installed motors.

1.3 DEFINITIONS

A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

C. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:

1. Each installed unit's type and details.
2. Nameplate legends.
3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

D. Qualification Data: For testing agency.

E. Test Reports: Written reports specified in Parts 2 and 3.

F. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain field-installed motors of a single type through one source from a single manufacturer.

C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

1. Compatible with the following:

   a. Magnetic controllers.
   b. Multispeed controllers.
   c. Reduced-voltage controllers.

2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
3. Matched to torque and horsepower requirements of the load.
4. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

A. Motor requirements apply to factory-installed and field-installed motors except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.
2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.2 MOTOR CHARACTERISTICS

A. Motors 3/4 HP and Larger: Three phase.

B. Motors Smaller Than 1/2 HP: Single phase.

C. Frequency Rating: 60 Hz.

D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

E. Service Factor: 1.15 for open drip proof motors; 1.0 for totally enclosed motors.

F. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.

G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure: Open drip proof.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Standard efficiency according to NEMA MG 1, Para. 12.59 and Table 12-10.

C. Stator: Copper windings, unless otherwise indicated.

1. Multispeed motors shall have separate winding for each speed.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 HP and larger; rolled steel for motors smaller than 7.5 HP.

1. Finish: Gray enamel.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer. Comply with the requirements of NEMA MG1, part 31.

1. Designed with critical vibration frequencies outside operating range of controller output.
2. Temperature Rise: Matched to rating for Class B insulation.
3. Insulation: Class H.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.

1. Finish: Chemical-resistant paint over corrosion-resistant primer.

D. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

2.5 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, pre-lubricated-sleeve type for other single-phase motors.

E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 MOTOR INSTALLATION

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. Install motors on concrete bases complying with Division 3.

3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
2. Test interlocks and control features for proper operation.
3. Verify that current in each phase is within nameplate rating.

B. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. 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. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Verify bearing lubrication.
4. Verify proper motor rotation.
5. Test Reports: Prepare a written report to record the following:

    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance.

3.4 ADJUSTING

A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

3.5 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 23 0513

SECTION 23 0519- METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 21 and 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes meters and gages for mechanical systems and water meters installed outside the building.

B. Utility-Furnished Products: Water meters will be furnished to site, ready for installation.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified.

C. Shop Drawings: Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.

D. Product Certificates: Signed by manufacturers of meters and gages certifying accuracies under specified operating conditions and compliance with specified requirements.

E. Shop Drawings: For brackets for duct-mounting thermometers.

F. Maintenance Data: For meters and gages to include in maintenance manuals specified in Division 23 Section “Basic Mechanical Requirements.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Liquid-in-Glass Thermometers:

a. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
b. Ernst Gage Co.
c. Marsh Bellofram.
d. Palmer Instruments, Inc.
e. Trerice: H. O. Trerice Co.
f. Weiss Instruments, Inc.
g. Winter's Thermogauges, Inc.

2. Pressure Gages:

a. AMETEK, Inc.; U.S. Gauge Div.
b. Dresser Industries, Inc.; Instrument Div.; Ashcroft Commercial Sales Operation.
c. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
d. Ernst Gage Co.
e. Helicoid.
f. Marsh Bellofram.
g. Noshok, Inc.
h. Trerice: H. O. Trerice Co.
i. Weiss Instruments, Inc.
j. WIKA Instruments Corp.
k. Winter's Thermogauges, Inc.

3. Test Plugs:

a. Flow Design, Inc.
b. MG Piping Products Co.
c. National Meter.
d. Peterson Equipment Co., Inc.
e. Sisco Manufacturing Co.
f. Trerice: H. O. Trerice Co.
g. Watts Industries, Inc.; Water Products Div.

2.2 THERMOMETERS, GENERAL

A. Scale Range: Temperature ranges for services listed are as follows:

1. Hot Water: 30 to 300 deg F, with 2-degree scale divisions (0 to 150 deg C, with 1-degree scale divisions).

B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Description: ASTM E 1.

B. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.

C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

D. Tube: Red or blue reading, organic-liquid filled with magnifying lens.

E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.

F. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

2.4 SEPARABLE SOCKETS

A. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

1. Material: Brass, for use in copper piping.
2. Material: Stainless steel, for use in steel piping.
3. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
4. Insertion Length: To extend to center of pipe.
5. Cap: Threaded, with chain permanently fastened to socket.
6. Heat-Transfer Fluid: Oil or graphite.

2.5 THERMOMETER WELLS

A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

1. Material: Brass, for use in copper piping.
2. Material: Stainless steel, for use in steel piping.
3. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
4. Insertion Length: To extend to center of pipe.
5. Cap: Threaded, with chain permanently fastened to socket.
6. Heat-Transfer Fluid: Oil or graphite.

2.6 PRESSURE GAGES

A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.

B. Case: Drawn steel, brass, or aluminum with 4-1/2-inch- (115-mm-) diameter, glass lens.

C. Connector: Brass, NPS 1/4 (DN8).

D. Scale: White-coated aluminum with permanently etched markings.

E. Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.

F. Range: Comply with the following:

1. Fluids under Pressure: Two times the operating pressure.

2.7 PRESSURE-GAGE FITTINGS

A. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

B. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.8 TEST PLUGS

A. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

B. Body: Length as required to extend beyond insulation.

C. Pressure Rating: 500 psig (3450 kPa) minimum.

D. Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch (3-mm) OD probe from dial-type thermometer or pressure gage.

E. Core Material for Air, Water, Oil, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.

F. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.

PART 3 - EXECUTION

3.1 METER AND GAGE INSTALLATION, GENERAL

A. Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER INSTALLATION

A. Install thermometers and adjust vertical and tilted positions.

B. Install in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.

C. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.

1. Install with socket extending to center of pipe.
2. Fill sockets with oil or graphite and secure caps.

D. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.

1. Install with stem extending to center of pipe.
2. Fill wells with oil or graphite and secure caps.

3.3 PRESSURE-GAGE INSTALLATION

A. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

B. Install liquid-filled-type pressure gages at suction and discharge of each pump.

C. Install pressure-gage needle valve and snubber in piping to pressure gages.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

1. Install meters and gages adjacent to machines and equipment to allow service and maintenance.

B. Electrical: Refer to Section 23 0510 “Basic Mechanical Requirements” for electrical connections to mechanical equipment.

3.5 ADJUSTING AND CLEANING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

C. Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 23 0519

SECTION 23 0523 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set ball and plug valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

E. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

F. Extended Valve Stems: On insulated valves.

G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. One-Piece, Copper-Alloy Ball Valves:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Div.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. DynaQuip Controls.
f. Grinnell Corporation.
g. Jamesbury, Inc.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. NIBCO INC.
k. Watts Industries, Inc.; Water Products Div.

C. Copper-Alloy Ball Valves, General: MSS SP-110.

D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, and 400-psig (2760-kPa) minimum CWP rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: One-piece, 400-psig (2760-kPa) CWP rating, copper alloy.

D. Heating Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: One-piece, 400-psig (2760-kPa) CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 0523

SECTION 23 0529 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 21 and 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:

a. B-Line Systems, Inc.
b. Grinnell Corp.

2. Channel Support Systems:

a. B-Line Systems, Inc.
b. Grinnell Corp.; Power-Strut Unit.
c. Thomas & Betts Corp.
d. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:

a. Pipe Shields, Inc.
b. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:

a. Gunnebo Fastening Corp.
b. Hilti, Inc.
c. ITW Ramset/Red Head.
d. Masterset Fastening Systems, Inc.
e. Rawl.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.

2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
3. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
6. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
9. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).

D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

E. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (675 kg).
    c. Heavy (MSS Type 33): 3000 lb (1350 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 0529

SECTION 23 0553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

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

C. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

D. Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, normal-operating position (open, closed, or modulating) and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Besides mounted copies, furnish copies for maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

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 location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries
2. Seton Name Plate Co.

2.2 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 23 Sections. If more than single-type, material, device, or label is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

C. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible.
7. Data: Name and plan number, equipment service, design capacity, other design parameters such as pressure drop, entering and leaving conditions, and speed.
8. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

D. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/16 inch, unless otherwise indicated.
4. Thickness: 1/8 inch, unless otherwise indicated.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

E. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

F. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Exterior, oil-based, alkyd gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

G. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

H. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive, vinyl type with permanent adhesive.

I. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
3. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.
4. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

5. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

    a. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

J. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cold-air supply.
2. Yellow: Hot-air supply.
3. Blue: Exhaust, outside, return, and mixed air.
4. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.
5. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin, duct destination, and design flow.

K. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 3/4 inch on pipes with OD, including insulation, less than 6 inches (150 mm); 1-1/2 inch for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

L. Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch- (0.8-mm-) thick, polished brass.
2. Material: 0.032-inch- (0.8-mm-) thick aluminum.

3. Material: 0.0375-inch- (1-mm-) thick stainless steel.
4. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
5. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.
7. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.

1. Frame: Finished hardwood.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.

N. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3 by 5 inches minimum.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

O. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 - EXECUTION

3.1 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fire department hose valves and hose stations.
    c. Meters, gages, thermometers, and similar units.
    d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    g. Fans, blowers, primary balancing dampers, and mixing boxes.
    h. Packaged HVAC central-station and zone-type units.
    i. Tanks and pressure vessels.
    j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Include signs for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    e. Fans, blowers, primary balancing dampers, and mixing boxes.
    f. Packaged HVAC central-station and zone-type units.
    g. Tanks and pressure vessels.
    h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

F. Install access panel markers with screws on equipment access panels.

3.2 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Marker Type: Stenciled markers with painted, color-coded bands or rectangles.

C. Marker Type: Stenciled markers complying with ASME A13.1.

D. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.

E. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.
2. Adhesive lap joint in pipe marker overlap.
3. Laminated or bonded application of pipe marker to pipe or insulation.
4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4 inch (20 mm) wide, lapped a minimum of 1-1/2 inches (40 mm) at both ends of pipe marker, and covering full circumference of pipe.

F. Fasten markers on pipes and insulated pipes 6 inches (150 mm) in diameter and larger by one of following methods:

1. Laminated or bonded application of pipe marker to pipe or insulation.
2. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2 inches (40 mm) wide, lapped a minimum of 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.
3. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

G. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near penetrations through walls, floors, ceilings, or nonaccessible 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 a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.3 VALVE TAGS

A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, 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 valve schedule.

B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:

1. Tag Size and Shape: According to the following:

a. Cold Water: 2 inches (50 mm), round.
b. Hot Water: 2 inches (50 mm), round.
c. Gas: 2 inches (50 mm), round.

2. Tag Color: According to the following:

   a. Cold Water: Blue.
   b. Hot Water: Red.
   c. Gas: Green.

3. Letter Color: According to the following:

   a. Cold Water: White.
   b. Hot Water: White.
   c. Gas: White.

C. Mount valve schedule on wall inaccessible location in each major equipment room.

D. Warning Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.

1. Identify operational valves and similar minor equipment items located in unoccupied spaces, including machine rooms, by installing plasticized tags.

E. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.

1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Duct Accessories.”
4. “Air Outlets and Inlets.”

1.2 SUMMARY

A. This Section specifies the requirements and procedures for the total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. The testing, adjusting and balancing agency will contract directly with the Owner. This contractor shall coordinate and make necessary adjustments to assist the TAB agency.

C. Test, adjust, and balance the following mechanical systems:

1. Supply air systems, all pressure ranges; including variable volume and double duct systems.
2. Return air systems.
3. Exhaust air systems.
4. Hydronic systems.
5. Verify temperature control system operation.
6. Laboratory fume hoods.

D. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes.
2. Specifications for materials for patching mechanical systems.
3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
4. Requirements and procedures for piping and ductwork systems leakage tests.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Agency Data:

1. Submit proof that the proposed Testing, Adjusting, and Balancing agency meets the qualifications specified below.

C. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

D. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

E. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in Operating and Maintenance Manual specified in Division 23 Section “Basic Mechanical Requirements.”

F. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC or NEBB are proposed.

G. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit at a minimum, (3) copies of the final report to the Engineer and (1) copy for inclusion in the O&M manual.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

    a. General Information and Summary
    b. Air Systems
    c. Hydronic Systems
    d. Temperature Control Systems
    e. Schematic diagrams

4. Report Contents: Provide the following minimum information, forms and data:

   a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
   b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form. System drawings shall include floor plans with identification marks corresponding to the marks in the report form.

H. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.4 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: A Professional Engineer (either on the installer's staff or an independent consultant), registered in the State in which the services are to be performed, and having at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications:

1. Employ the services of an independent Testing, Adjusting, and Balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. The independent testing, adjusting, and balancing agency certified by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC or NEBB as a Test and Balance Engineer.

C. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
2. AABC: "National Standards For Total System Balance."
3. ASHRAE: Handbook, 1995 "HVAC Applications", Chapter 34, Testing, Adjusting, and Balancing.
4. American Industrial Hygiene Association, 1992. ANSI/AIHA Z9.5-1992: American National Standard for Laboratory Ventilation.

D. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.5 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.6 SEQUENCING AND SCHEDULING

A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.

B. Respective of which operational season the system is operating in at the time of initial testing, an opposite season check of the system is required prior to the final report results being issued. A draft report shall be issued for review after initial testing.

1.7 SPECIAL GUARANTEE

A. Provide a guarantee on the applicable certification Agency (NEBB or AABC) forms stating that the NEBB or AABC, respectively, will assist in completing the requirements of the Contract documents in the event that the testing, adjusting and balancing Agent fails to comply with, or complete the work specified under this division of the Specification. The guarantee shall also include the following provisions.

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within the design and installation limits.
3. Address, phone number and contact person at the respective certification Agency (NEBB or AABC) should it become necessary to request the certification Agency's assistance in completing the work under this division of the Specification.

PART 2 - PRODUCTS

2.1 TESTING, ADJUSTING, AND BALANCING AGENCIES

A. Firms: Subject to compliance with requirements, provide the services of one of the following firms:

1. Doyle Field Services (816) 444-7103
2. AccuTec Services, Inc. (816) 215-3966
3. Pre-Approved Alternate

B. Firms who are not listed, but would like to be considered must submit a written request for approval at least 10 days prior to bid.

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Prepare “punch list” of items the contractor must correct prior to commencing work.

2. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
3. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
4. Compare design to installed equipment and field installations.
5. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
6. Check filters for cleanliness.
7. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
8. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
9. Determine best locations in main and branch ductwork for most accurate duct traverses.
10. Place outlet dampers in the full open position.
11. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
12. Lubricate all motors and bearings.
13. Check fan belt tension.
14. Check fan rotation.

3.2 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system perform these steps:

1. Prepare "punch list" of items the contractor must correct prior to commencing work.
2. Open valves to full open position. Close coil bypass valves.
3. Remove and clean all strainers.
4. Examine hydronic systems and determine if water has been treated and cleaned.
5. Check pump rotation.
6. Clean and set automatic fill valves for required system pressure.
7. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
8. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
9. Set temperature controls so all coils are calling for full flow.
10. Check operation of automatic bypass valves.
11. Check and set operating temperatures of chillers to design requirements.
12. Lubricate all motors and bearings.

3.3 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.4 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

H. Test, adjust and balance domestic hot water circulating loops so that the pressure drop in each loop is equal.

3.5 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION 23 0593

SECTION 23 0700 - MECHANICAL INSULATION

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 this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Hangers and Supports” for pipe insulation shields and protection saddles.

1.2 SUMMARY

A. This Section includes pipe, duct, and equipment insulation.

1.3 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 deg F (38 deg C) or higher.

B. Cold Surfaces: Normal operating temperatures less than 75 deg F (24 deg C).

C. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees Fahrenheit between the two exposed faces required to cause 1 BTU per hour to flow through 1 square foot at mean temperatures indicated.

D. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F.

E. Density: Is expressed in lb/cu. ft.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

1.5 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Glass Fiber:

a. CertainTeed Corporation.
b. Knauf Fiberglass GmbH.
c. Schuller International (Manville).
d. Owens-Corning Fiberglas Corporation.
e. USG Interiors, Inc. - Thermafiber Division.

2. Cellular Glass:

a. Pittsburgh Corning Corporation.

2.2 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Board: ASTM C 612, Type 1B, semi-rigid jacketed board, provide FSK foil facing.

1. Thermal Conductivity: 0.23 average maximum, at 75 deg F mean temperature.
2. Density: 3 pcf minimum.

D. Blanket: ASTM C 553, Type II, FSK facing, jacketed flexible blankets.

1. Thermal Conductivity: 0.26 average maximum, at 75 deg F mean temperature.
2. Density: 1 pcf.

E. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, with all service jacket.

1. Thermal Conductivity: 0.23 average maximum at 75 deg F mean temperature.

F. Adhesive: Produced under the UL Classification and Follow-up service.

1. Type: Non-flammable, solvent-based.
2. Service Temperature Range: Minus 20 to 180 deg F.

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.3 CELLULAR GLASS

A. Material: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, noncombustible.

B. Facing: ASTM C 921, Type 1, factory-applied, laminated foil, flame-retardant, vinyl facing.

C. Form: The following as indicated:

1. Blocks: ASTM C 552, Type I.
2. Boards: ASTM C 552, Type IV.
3. Preformed Pipe: ASTM C 552, Type II, Class 2 (jacketed).
4. Special Shapes: ASTM C 552, Type III, in shapes and thicknesses as indicated.

D. Thermal Conductivity:

1. 0.33 average maximum at 40 deg F mean temperature.
2. 0.35 average maximum at 75 deg F mean temperature.
3. 0.44 average maximum at 200 deg F mean temperature.

E. Minimum Density: 6.7 pcf.

F. Maximum Density: 9.5 pcf.

2.4 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

1. Tubular Materials: ASTM C 534, Type I.
2. Sheet Materials: ASTM C 534, Type II.

B. Thermal Conductivity: 0.27 average maximum at 75 deg F.

C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.5 INSULATING CEMENTS

A. Mineral Fiber: ASTM C 195.

1. Thermal Conductivity: 1.0 average maximum at 500 deg F mean temperature.
2. Compressive Strength: 10 psi at 5 percent deformation.

B. Expanded or Exfoliated Vermiculite: ASTM C 196.

1. Thermal Conductivity: 1.10 average maximum at 500 deg F mean temperature.
2. Compressive Strength: 5 psi at 5 percent deformation.

C. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.

1. Thermal Conductivity: 1.2 average maximum at 400 deg F mean temperature.
2. Compressive Strength: 100 psi at 5 percent deformation.

2.6 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:

1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.7 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.

2.8 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.

1. Tape Width: 4 inches.
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.01 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 14 gage nickel copper alloy, 16 gage, soft-annealed stainless steel, or 16 gage, soft-annealed galvanized steel.

D. Corner Angles: 28 gage, 1 inch by 1 inch aluminum, adhered to 2 inches by 2 inches kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.9 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm maximum.
2. Temperature Range: Minus 20 to 180 deg F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.

1. Water Vapor Permeance: 0.02 perm maximum.
2. Temperature Range: Minus 50 to 250 deg F (Minus 46 to 121 deg C).
3. Color: Aluminum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.

1. Follow cement manufacturer's printed instructions for mixing and portions.

3.2 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces. The final appearance of the insulation work shall be neat, workmanlike and an attractive insulation system.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing. Insulation which has become wet during application shall be removed and discarded, and cost shall be incurred by contractor.

K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors for ducts and pipes.
4. Vibration control devices.
5. Testing laboratory labels and stamps.
6. Nameplates and data plates.
7. Access panels and doors in air distribution systems.
8. Sanitary drainage and vent piping.
9. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
10. Piping specialties including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

L. The Contractor shall be responsible for coordination with other building disciplines before installation is performed. Progressive testing of systems to be insulated shall have been completed, inspected, and approved before insulation is applied.

3.3 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation. Properly secure each insulation layer.

C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Cover circumferential joints with butt strips, at least 3 inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply 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 on center.

a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F.

4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

F. Exterior Wall Penetrations: For penetrations of above or below grade exterior walls, extend metal jacket for exterior insulation through penetration to a point 2 inches (50 mm) from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to jacket to form a watertight seal.

G. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 23 Section “Basic Mechanical Materials and Methods.”

H. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 23 Section “Basic Mechanical Materials and Methods” for firestopping and fire-resistant joint sealer.

I. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.

J. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.

1. Use same material and thickness as adjacent pipe insulation.
2. Overlap nesting insulation by 2 inches or 1-pipe diameter, which ever is greater.
3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
4. Insulate elbows and tees smaller than 3 inches pipe size with premolded insulation.
5. Insulate elbows and tees 3 inches and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips (PVC tape).
7. Cover insulation, except for metal jacketed insulation, with 2 layers of lagging adhesive to a minimum thickness of 1/16 inch. Install glass cloth between layers. Overlap adjacent insulation by 2 inches in both directions from joint with glass cloth and lagging adhesive.

K. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 23 Section "Hangers and Supports." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.4 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

3.5 CELLULAR GLASS PIPE INSULATION INSTALLATION

A. Cellular Glass Insulation: Join sections of cellular glass insulation with vapor barrier compound. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.

1. Multiple Layer Installations: Stagger joints of multilayer installations. Secure inner layer with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.
2. Finishing: Apply manufacturer's recommended weather barrier mastic.
3. Finishing: Apply metal jacket over manufacturer's recommended vapor barrier mastic.

3.6 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints (both surfaces of longitudinal and butt) with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.

1. Miter cut materials to cover soldered elbows and tees.
2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.7 DUCT INSULATION

A. Install block and board insulation as follows:

1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.
2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

B. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches: Bonding adhesive applied in 6 inches wide transverse strips on 12 inches centers.

2. 24 Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.
3. Overlap joints 3 inches.
4. Seal joints, breaks, and punctures with vapor barrier compound.

3.8 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2 inches laps at longitudinal joints and 3 inch wide butt strips at end joints.

1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

B. Exterior Exposed Insulation: Install continuous aluminum jackets and seal all joints and seams with waterproof sealant.

C. Install metal jacket with 2 inches overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel draw bands 12 inches on center and at butt joints.

3.9 FINISHES

A. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.10 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Interior, Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Domestic cold water.
2. Domestic hot water.
3. Recirculated hot water.
4. Sanitary drains for fixtures accessible to the disabled.
5. Low-temperature hydronic (0 to 34 deg F).
6. Refrigerant suction.
7. Refrigerant liquid lines within reach of building occupants.
8. Refrigerant hot gas and vapor lines.
9. Refrigerant high pressure liquid lines from condenser to expansion valve.
10. Hydronic piping (100 to 250 deg F).
11. Condensate drains.

C. Exterior, Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Refrigerant.
2. Hydronic piping (100 to 250 deg F).

D. Duct Systems: Unless otherwise indicated, insulate the following duct systems:

1. Interior concealed supply, return and outside air ductwork.
2. Interior exposed supply, return and outside air ductwork.
3. Exterior exposed supply and return ductwork.
4. Interior exposed and concealed supply fans, air handling unit casings and outside air plenums which aren't factory insulated.
5. Interior relief ductwork from fan discharge to relief louver, 15' maximum from building penetration.

E. See Division 23 Section "Metal Ductwork", Part 3, for duct systems which require duct liner.

3.11 PIPE INSULATION SCHEDULES

A. General: Abbreviations used in the following schedules include:

1. Field-Applied Jackets: P - PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel.
2. Pipe Sizes: NPS - Nominal Pipe Size.

INTERIOR DOMESTIC COLD WATER AND CONDENSATE DRAINS

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
ALL	GLASS FIBER	1/2	YES	NONE
	MINERAL FIBER	1/2	YES	NONE

INTERIOR DOMESTIC HOT WATER AND RECIRCULATED HOT WATER

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	1	NO	NONE
	CELLULAR GLASS	1	NO	NONE
1-1/2 TO 4	GLASS FIBER	1	NO	NONE
	CELLULAR GLASS	1	NO	NONE

INTERIOR LOW-TEMPERATURE HYDRONIC (0 TO 34 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	1-1/2	YES	NONE
	CELLULAR GLASS	1	YES	NONE
1-1/2 TO 4	GLASS FIBER	2	YES	NONE
	CELLULAR GLASS	1-1/2	YES	NONE

INTERIOR REFRIGERANT SUCTION, REFRIGERANT LIQUID EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	FLEXIBLE ELASTOMERIC	1	YES	NONE
1-1/2 TO 4	FLEXIBLE ELASTOMERIC	1	YES	NONE

EXTERIOR REFRIGERANT SUCTION AND DUAL-TEMP HYDRONIC (35 TO 100 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	2	YES	(P)(A)(SS)
	CELLULAR GLASS	2	YES	(P)(A)(SS)
	FLEXIBLE ELASTOMERIC	2	YES	NONE
1-1/2 TO 4	GLASS FIBER	2	YES	(P)(A)(SS)
	CELLULAR GLASS	2-1/2	YES	(P)(A)(SS)
	FLEXIBLE ELASTOMERIC	2	YES	NONE
5 TO 10	GLASS FIBER	2-1/2	YES	(P)(A)(SS)
	CELLULAR GLASS	2-1/2	YES	(P)(A)(SS)
12 TO 36	GLASS FIBER	2-1/2	YES	(P)(A)(SS)
	CELLULAR GLASS	3	YES	(P)(A)(SS)

INTERIOR HYDRONIC (100 TO 200 DEG F) AND INTERIOR REFRIGERANT VAPOR, HIGH PRESSURE LIQUID AND HOT GAS PIPING EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 4	GLASS FIBER	1-1/2	NO	NONE
	CELLULAR GLASS	1-1/2	NO	NONE

3.12 DUCT SYSTEMS INSULATION SCHEDULES

INTERIOR CONCEALED HVAC SUPPLY, OUTSIDE AND RELIEF DUCTS AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BLANKET	1-1/2	YES	NONE

INTERIOR EXPOSED HVAC SUPPLY, OUTSIDE AND RELIEF DUCTS (ROUND AND RECTANGULAR) AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BOARD	1-1/2	YES	NONE

INTERIOR EXPOSED HVAC SUPPLY FANS, AIR HANDLING UNITS, CASING, AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BOARD	2	YES	NONE

INTERIOR CONCEALED EXHAUST DUCTS (FIFTEEN FEED FROM EXERIOR WALL)

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BOARD	2	NO	NONE

EXTERIOR EXPOSED HVAC SUPPLY, RETURN AND RELIEF DUCTS (ROUND AND RECTANGULAR) AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BOARD.	3	YES	EPDM
FLEXIBLE ELASTOMERIC	SHEET	3	YES	(P)

END OF SECTION 23 0700

SECTION 23 0923 – BUILDING MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades.

B. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

C. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.2 BMS DESCRIPTION

A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

C. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

F. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.

2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BMS functions.
5. Offsite monitoring and management access.
6. Energy management.
7. Standard applications for terminal HVAC systems.

1.3 WORK BY OTHERS

A. The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX

BMS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUB	LINE POWER
BMS low voltage and communication wiring	BMS	BMS	BMS	N/A
BMS conduits and raceway	BMS	BMS	BMS	BMS
Automatic dampers	BMS	23	N/A	N/A
Manual valves	23	23	N/A	N/A
Automatic valves	BMS	23	BMS	N/A
Pipe insertion devices and taps including thermowells, flow and pressure stations.	BMS	23	BMS	BMS
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
Power distribution system monitoring interfaces	26	26	BMS	26
All BMS Nodes, equipment, housings,	BMS	BMS	BMS	BMS
Smoke Detectors	26	26	26	26
Fire Alarm shutdown relay interlock wiring	26	26	26	26
Starters, HOA switches	26	26	N/A	26
Control damper actuators	BMS	BMS	BMS	26

1.4 SUBMITTALS

A. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
4. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.

5. The BMS Contractor shall correct any errors or omissions noted in the first review.
6. At a minimum, submit the following:

    a. BMS network architecture diagrams including all nodes and interconnections.
    b. Systems schematics, sequences and flow diagrams.
    c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address. d.Samples of Graphic Display screen types and associated menus.
    d. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
    e. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
    f. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
    g. Details of all BMS interfaces and connections to the work of other trades.
    h. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.5 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:

    a. Table of contents.
    b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal. Provide “first draft” of as-built system record drawings to project commissioning agent no later than project completion date.
    c. Manufacturers product data sheets or catalog pages for all products including software.
    d. System Operator’s manuals.
    e. Archive copy of all site-specific databases and sequences.
    f. BMS network diagrams.
    g. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.6 WARRANTY

A. Standard Material and Labor Warranty:

1. Provide a one-year labor and material warranty on the BMS.

2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
3. Warranty work shall be done during BMS Contractor's normal business hours.

PART 2 – PRODUCTS

2.1 GENERAL DESCRIPTION

A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third- party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

B. The Building Management System shall consist of the following:

1. Standalone Network Automation Engine(s)
2. Field Equipment Controller(s)
3. Input/Output Module(s)
4. Local Display Device(s)
5. Portable Operator's Terminal(s)
6. Distributed User Interface(s)
7. Network processing, data storage and communications equipment
8. Other components required for a complete and working BMS

C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
2. The System shall maintain all settings and overrides through a system reboot.

E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

F. Acceptable Manufacturers

1. Johnson Controls Metasys (JCI)
2. Automated Logic Controls (ALC)
3. Critical Room Control (CRC)

2.2 BMS ARCHITECTURE

A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.
3. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
4. Network Automation Engines (NAE) shall reside on the automation network.
5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

B. Control Network

1. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols, as necessary for the specific project:

    a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9

        1) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
        2) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).

    b. LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
    c. The Johnson Controls N2 Field Bus.

2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.

C. Integration

1. Hardwired

    a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
    b. There will be one separate physical point on each system for each point to be integrated between the systems.

2. Direct Protocol (Integrator Panel)

    a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers' control panels. The BMS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.
    b. All data required by the application shall be mapped into the Automation Engine's database, and shall be transparent to the operator.
    c. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.

3. BACnet Protocol Integration - BACnet

    a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2003.
    b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
    c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.3 USER INTERFACE

A. Existing.

2.4 NETWORK AUTOMATION ENGINES (NAE)

A. Network Automation Engine (NAE 55XX)

1. The standard NAE shall be an NAE 55XX unless the application requires that a different model be utilized. Confirm with BCBSKS representatives on each specific project. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.
3. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

    a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
    b. The NAE shall support up a minimum of four (4) concurrent users.
    c. The web based user shall have the capability to access all system data through one NAE.
    d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
    e. Systems that require the user to address more than one NAE to access all system information are not acceptable.

f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:

1) Configuration
2) Commissioning
3) Data Archiving
4) Monitoring
5) Commanding
6) System Diagnostics

i. Systems that require workstation software or modified web browsers are not acceptable.

j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.

4. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
5. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
6. Hardware Real Time Clock – The NAE shall include an integrated, hardware- based, real-time clock.
7. The NAE shall include troubleshooting LED indicators to identify the following conditions:

a. Power - On/Off
b. Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
c. Ethernet Connection Speed – 10 Mbps/100 Mbps
d. FC Bus A – Normal Communications/No Field Communications
e. FC Bus B – Normal Communications/No Field Communications
f. Peer Communication – Data Traffic between NAE Devices
g. Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running
h. Bat Fault – Battery Defective, Data Protection Battery Not Installed
i. 24 VAC – 24 VAC Present/Loss Of 24VAC
j. Fault – General Fault
k. Modem RX – NAE Modem Receiving Data
l. Modem TX – NAE Modem Transmitting Data

8. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.

a. Two (2) USB port
b. Two (2) URS-232 serial data communication port
c. Two (2) RS-485 port
d. One (1) Ethernet port

9. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

10. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

    a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
    b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

11. Certification – The NAE shall be listed by Underwriters Laboratories (UL).
12. Controller network – The NAE shall support the following communication protocols on the controller network:

    a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.

        1) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
        2) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
        3) A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
        4) The Conformance Statements shall be submitted 10 days prior to bidding.
        5) The NAE shall support a minimum of 100 control devices.

    b. The NAE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10.

        1) All LonWorks controls devices shall be LonMark certified.
        2) The NAE shall support a minimum of 255 LonWorks enabled control devices.

    c. The NAE shall support the Johnson Controls N2 Field Bus.

        1) The NAE shall support a minimum of 100 N2 control devices.
        2) The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
        3) The Bus shall employ a master/slave protocol where the NAE is the master.
        4) The Bus shall employ a four (4) level priority system for polling frequency.
        5) The Bus shall be optically isolated from the NAE.
        6) The Bus shall support the Metasys Integrator System.

2.5 DDC SYSTEM CONTROLLERS

A. Field Equipment controller (FEC X610)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.

    a. The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.

        1) The FEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
        2) The FEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).

3) A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
4) The Conformance Statement shall be submitted 10 days prior to bidding.

2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The FEC shall include a removable base to allow pre-wiring without the controller.
6. The FEC shall include troubleshooting LED indicators to identify the following conditions:

a. Power On
b. Power Off
c. Download or Startup in progress, not ready for normal operation
d. No Faults
e. Device Fault
f. Field Controller Bus - Normal Data Transmission
g. Field Controller Bus - No Data Transmission
h. Field Controller Bus - No Communication
i. Sensor-Actuator Bus - Normal Data Transmission
j. Sensor-Actuator Bus - No Data Transmission
k. Sensor-Actuator Bus - No Communication

7. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
8. The FEC shall support the following types of inputs and outputs:

a. Universal Inputs - shall be configured to monitor any of the following:

1) Analog Input, Voltage Mode
2) Analog Input, Current Mode
3) Analog Input, Resistive Mode
4) Binary Input, Dry Contact Maintained Mode
5) Binary Input, Pulse Counter Mode

b. Binary Inputs - shall be configured to monitor either of the following:

1) Dry Contact Maintained Mode
2) Pulse Counter Mode

c. Analog Outputs - shall be configured to output either of the following

1) Analog Output, Voltage Mode
2) Analog Output, current Mode

d. Binary Outputs - shall output the following:

1) 24 VAC Triac

e. Configurable Outputs - shall be capable of the following:

1) Analog Output, Voltage Mode
2) Binary Output Mode

9. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).

a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
b. The FC Bus shall support communications between the FECs and the NAE.
c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
d. The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
e. The FC Bus shall operate at a maximum distance of 23,000 Ft. between the FEC and the furthest connected device.

10. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
b. The SA Bus shall support a minimum of 10 devices per trunk.
c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.

11. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
12. The FEC shall support, but not be limited to, the following:

a. Hot water, chilled water/central plant applications.
b. Built-up air handling units for special applications.
c. Terminal Units.
d. Special programs as required for systems control.

2.6 FIELD DEVICES/CONTROLLERS

A. Input/Output Module (IOM X710)

1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC.
2. The IOM shall communicate with the FEC over the FC Bus or the SA Bus.
3. The IOM shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.

a. The IOM shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
b. The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
c. A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
d. The Conformance Statement shall be submitted 10 days prior to bidding.

4. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The IOM shall have a minimum of 4 points to a maximum of 17 points.

6. The IOM shall support the following types of inputs and outputs:

    a. Universal Inputs - shall be configured to monitor any of the following:

        1) Analog Input, Voltage Mode
        2) Analog Input, Current Mode
        3) Analog Input, Resistive Mode
        4) Binary Input, Dry Contact Maintained Mode
        5) Binary Input, Pulse Counter Mode

    b. Binary Inputs - shall be configured to monitor either of the following:

        1) Dry Contact Maintained Mode
        2) Pulse Counter Mode

    c. Analog Outputs - shall be configured to output either of the following

        1) Analog Output, Voltage Mode
        2) Analog Output, current Mode

    d. Binary Outputs - shall output the following:

        1) 24 VAC Triac

    e. Configurable Outputs - shall be capable of the following:

        1) Analog Output, Voltage Mode
        2) Binary Output Mode

7. The IOM shall include troubleshooting LED indicators to identify the following conditions:

    a. Power On
    b. Power Off
    c. Download or Startup in progress, not ready for normal operation
    d. No Faults
    e. Device Fault
    f. Normal Data Transmission
    g. No Data Transmission
    h. No Communication

B. Networked Thermostat (TEC 26X6)

1. Networked thermostat shall be capable of controlling a variety of terminal HVAC systems or similar equipment. Exact model of TEC shall be determined by project.
2. The TEC shall communicate over the Field Controller Bus using BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
3. The TEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

    a. The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
    b. A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.
    c. The Conformance Statement shall be submitted 10 days prior to bidding.

4. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.

5. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.

    a. Two line, 8 character backlit display
    b. LED indicators for Fan, Heat, and Cool status
    c. Five (5) User Interface Keys

        1) Mode
        2) Fan
        3) Override
        4) Degrees C/F
        5) Up/Down

    d. The display shall continuously scroll through the following parameters:

        1) Room Temperature
        2) System Mode
        3) Schedule Status – Occupied/Unoccupied/Override
        4) Applicable Alarms

6. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:

    a. Integral Indoor Air Temperature Sensor
    b. Duct Mount Air Temperature Sensor
    c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
    d. Two configurable binary inputs

7. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:

    a. Three Speed Fan Control
    b. Two On/Off
    c. Two Floating
    d. Two Proportional (0 to 10V)

8. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
9. The Networked Thermostat shall provide the flexibility to adjust the following parameters:

    a. Adjustable Temporary Occupancy from 0 to 24 hours
    b. Adjustable heating/cooling deadband from 2º F to 5º F
    c. Adjustable heating/cooling cycles per hour from 4 to 8

10. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

C. VAV Modular Assembly (VMA 26X0)

1. The VAV Modular Assembly shall provide both standalone and networked direct digital control of pressure-independent, variable air volume terminal units. It shall address both single and dual duct applications.
2. The VMA shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

    a. The VMA shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
    b. A BACnet Protocol Implementation Conformance Statement shall be provided for the VMA.
    c. The Conformance Statement shall be submitted 10 days prior to bidding.

3. The VAV Modular Assembly shall communicate over the FC Bus using BACnet Standard protocol SSPC-135, Clause 9.
4. The VAV Modular Assembly shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications. An externally mounted isolation transformer shall not be acceptable.
5. The VAV Modular Assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece.
6. The VAV Modular Assembly shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
7. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 30 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.
8. The controller shall determine airflow by dynamic pressure measurement using an integral dead-ended differential pressure transducer. The transducer shall be maintenance-free and shall not require air filters.
9. Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.
10. The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
11. Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. In addition, this tuning reduces commissioning costs, and eliminates the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.
12. The controller shall provide the ability to download and upload VMA configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
13. Control setpoint changes initiated over the network shall be written to VMA non- volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
14. The controller firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.
15. The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
16. The controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain (“K” factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
17. Controller performance shall be self-documenting via on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop’s sample interval, which may be used to continuously monitor and document system performance. The VMA shall calculate exponentially weighted moving averages (EWMA) for each of the following. These metrics shall be available to the end user for efficient management of the VAV terminals.

    a. Absolute temperature loop error
    b. Signed temperature loop error
    c. Absolute airflow loop error
    d. Signed airflow loop error
    e. Average damper actuator duty cycle

18. The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:

    a. Unreliable space temperature sensor
    b. Unreliable differential pressure sensor
    c. Starved box

d. Actuator stall
e. Insufficient cooling
f. Insufficient heating

19. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The VMA would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.
20. The controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality), and shall be capable of resetting the box minimum airflow Based on the percent of outdoor air in the primary air stream.
21. The controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.
22. Inputs:

    a. Analog inputs with user defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:

        1) 0-10 VDC Sensors
        2) 1000ohm RTDs
        3) NTC Thermistors

    b. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input “bouncing.”
    c. For noise immunity, the inputs shall be internally isolated from power, communications, and output circuits.
    d. Provide side loop application for humidity control.

23. Outputs

    a. Analog outputs shall provide the following control outputs:

        1) 0-10 VDC

    b. Binary outputs shall provide a SPST Triac output rated for 500mA at 24 VAC.
    c. For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.

24. Application Configuration

    a. The VAV Modular Assembly shall be configured with a software tool that provides a simple Question/Answer format for developing applications and downloading.

25. Sensor Support

    a. The VAV Modular Assembly shall communicate over the Sensor-Actuator Bus (SA Bus) with a Network Sensor.
    b. The VMA shall support an LCD display room sensor.
    c. The VMA shall also support standard room sensors as defined by analog input requirements.
    d. The VMA shall support humidity sensors defined by the AI side loop.

D. Network Sensors (NS-XXX700X)

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:

    a. Zone Temperature
    b. Zone Humidity
    c. Zone Setpoint
    d. Discharge Air Temperature

2. The NS shall transmit the information back to the controller on the Sensor- Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
3. The NS shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

    a. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
    b. A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
    c. The Conformance Statement shall be submitted 10 days prior to bidding.

4. The Network Zone Sensors shall include the following items:

    a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
    b. An LED to indicate the status of the Override feature
    c. A button to toggle the temperature display between Fahrenheit and Celsius
    d. A button to initiate a timed override command
    e. Available in either surface mount or wall mount
    f. Available with either screw terminals or phone jack

5. The Network Discharge Air Sensors shall include the following:

    a. 4 inch or 8 inch duct insertion probe
    b. 10 foot pigtail lead
    c. Dip Switches for programmable address selection
    d. Ability to provide an averaging temperature from multiple locations
    e. Ability to provide a selectable temperature from multiple locations

2.7 SYSTEM TOOLS

A. System Configuration Tool (SCT)

1. The Configuration Tool software is existing and shall be utilized for the development of software on this project.

2.8 INPUT DEVICES

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

1. General Requirements:

a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	Accuracy
Chilled Water	± .5□F.
Room Temp	± .5□F.
Duct Temperature	± .5□F.
All Others	± .75□F.

2. Room Temperature Sensors

a. Room sensors shall be constructed for either surface or wall box mounting.
b. Room sensors shall have the following options when specified:

1) Setpoint reset slide switch providing a ±3 degree (adjustable) range.
2) Individual heating/cooling setpoint slide switches.
3) A momentary override request push button for activation of after- hours operation.
4) Analog thermometer.

3. Room Temperature Sensors with Integral Display

a. Room sensors shall be constructed for either surface or wall box mounting.
b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:

1) Display room and outside air temperatures.
2) Display and adjust room comfort setpoint.
3) Display and adjust fan operation status.
4) Timed override request push button with LED status for activation of after-hours operation.
5) Display controller mode.
6) Password selectable adjustment of setpoint and override modes.

4. Thermo wells

a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
b. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.

c. Thermo wells and sensors shall be mounted in a threadolet or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
d. Thermo wells shall be constructed of 326 stainless steel.

5. Outside Air Sensors

a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

6. Duct Mount Sensors

a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

7. Averaging Sensors

a. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
c. Capillary supports at the sides of the duct shall be provided to support the sensing string.

8. Acceptable Manufacturers: Johnson Controls (JCI), Automated Logic Controls (ALC), Setra.

C. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
d. Acceptable manufacturers: Veris Industries.

3. Low Temperature Limit Switches

a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 26 amps at 120VAC.
b. The sensing element shall be a minimum of 23 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
d. The low temperature limit switch shall be equal to Johnson Controls A70.

2.9 OUTPUT DEVICES

A. Actuators

1. General Requirements

a. Damper and valve actuators shall be electronic and/or pneumatic, as specified in the System Description section.

2. Electronic Damper Actuators

a. Electronic damper actuators shall be direct shaft mount.
b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 23 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
e. Acceptable manufacturers: Johnson Controls, Mamac.

3. Electronic Valve Actuators

   a. Electronic valve actuators shall be manufactured by the valve manufacturer.
   b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.
   c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
   d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10VDC. The feedback signal shall be independent of the input signal, andmay be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
   e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.
   f. Acceptable manufacturers: Johnson Controls

B. Control Dampers

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close- off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 26-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 26-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std.500.
5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 2300 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD50, and Vent Products 5650.
6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 2300 FPM or below. Acceptable manufacturers are: Johnson Controls D-2600, Ruskin CD36, and Vent Products 5800.
7. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays

a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
b. Mounting Bases shall be snap-mount.
c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
d. Contacts shall be rated for 10 amps at 120VAC.
e. Relays shall have an integral indicator light and check button.
f. Acceptable manufacturers: Johnson Controls, Lectro

D. Control Valves

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.
2. Chilled water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 PSI. Valves (3-way) serving constant flow air handling unit coils with secondary circuit pumps shall be sized for a pressure drop equal to 25% the actual coil pressure drop, but no less than 2 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 PSI. Valves for terminal reheat coils shall be sized for a 2 PSIG pressure drop, but no more than a 5 PSI drop.
3. Ball valves shall be used for hot and chilled water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.
4. Modulating plug water valves of the single-seat type with equal percentage flow characteristics shall be used for all special applications as indicated on the valve schedule. Valve discs shall be composition type. Valve stems shall be stainless steel.
5. Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In- line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane. Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.
6. Pressure independent delta-p valves may be used for hydronic heating applications.

E. External Manual Override Stations

1. External manual override stations shall provide the following:

a. An integral HAND/OFF/AUTO switch shall override the controlled device pilot relay.
b. A status input to the Facility Management System shall indicate whenever the switch is not in the automatic position.
c. A Status LED shall illuminate whenever the output is ON.

d. An Override LED shall illuminate whenever the HOA switch is in either the HAND or OFF position.
e. Contacts shall be rated for a minimum of 1 amp at 24 VAC.

F. Electronic/Pneumatic Transducers

1. Electronic to Pneumatic transducers shall provide:

a. Output: 3-23 PSIG.
b. Input: 4-20 mA or 0-10 VDC.
c. Manual output adjustment.
d. Pressure gauge.
e. External replaceable supply air filter.
f. Acceptable manufacturers: Johnson Controls, Mamac

2.10 MISCELLANEOUS DEVICES

A. Local Control Panels

1. All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and aslotted flush latch.
2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the palns, and I/O devices – such as relays, transducers, and so forth – that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in thepanel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provided via removable or fixed screw terminals.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

B. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC - 10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Repple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.
9. When the application is life safety or mission critical, provide an uninterruptible power supply of capacity and duration sufficient to maintain operation of system.

PART 3 – PERFORMANCE / EXECUTION

3.1 BMS SPECIFIC REQUIREMENTS

A. Graphic Displays

1. Graphics will be developed for the project will be representative of the systems controlled by the BMS. Floor plans will be provided by the project Architect/Engineer and will be used to develop floor-level graphics to speed recognition and response for operation of BMS. Level of graphics capability will be based on the type of system controlled.

    a. Provide floor plan(s) defining spaces that are served by each air handling unit.
    b. Provide schematic drawing showing the unit configuration and control devices for each air handling unit.

B. Custom Reports:

1. As required.

C. Actuation / Control Type

1. Primary Equipment

    a. Controls shall be provided by equipment manufacturer as specified herein.
    b. All damper and valve actuation shall be electric.

2. Air Handling Equipment

    a. All air handers shall be controlled with a HVAC-DDC Controller
    b. All damper and valve actuation shall be electric.

3. Terminal Equipment:

    a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.
    b. All Terminal Units shall be controlled with HVAC-DDC Controller)

3.2 INSTALLATION PRACTICES

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.

3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring

    a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
    b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
2. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation.
2. Locate components of the BMS in accessible local control panels wherever possible.

H. HVAC Input Devices – General

1. All Input devices shall be installed per the manufacturer recommendation.
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors

    a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
    b. Sensors shall be installed with a rain proof, perforated cover.

6. Duct Temperature Sensors:

    a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
    b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
    c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
    d. The sensor shall be mounted to suitable supports using factory approved element holders.

7. Space Sensors:

    a. Shall be mounted per ADA requirements, or as stated on project drawings.
    b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.

8. Low Temperature Limit Switches:

    a. Install on the discharge side of the first water or steam coil in the air stream.
    b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
    c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

I. HVAC Output Devices

1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.3 TRAINING

A. The BMS contractor shall provide the following training services:

1. One day (8 hours or as determined by project requirements) of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

    a. System technician shall demonstrate the operation of each air handling unit device and conformance to the project sequence of operation.
    b. Demonstration shall be coordinated with project commissioning agent.

3.4 COMMISSIONING

A. Fully commission all aspects of the Building Management System work.

B. Acceptance Check Sheet

1. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.
2. Submit the check sheet to the Engineer for approval
3. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.

C. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION 23 0923

SECTION 23 2113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section:

1. "Basic Mechanical Requirements."
2. "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
3. "Valves" for general duty, gate, globe, ball, butterfly, and check valves.
4. "Meters and Gages" for thermometers, flow meters, and pressure gages.
5. "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
6. "Mechanical Identification" for labeling and identifying hydronic piping.
7. "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
8. "Testing, Adjusting, and Balancing" for hydronic system adjusting and balancing.

1.2 SUMMARY

A. This Section includes piping, special-duty valves, and hydronic specialties for hot water heating, chilled water cooling, and condenser water systems; makeup water for these systems; blow-down drain lines; and condensate drain piping.

1.3 SYSTEM DESCRIPTION

A. Freeze Protection: Provide 30% concentration by volume of inhibited ethylene glycol solution to filled chilled water system and heating hot water system.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section "Basic Mechanical Requirements."

B. Product Data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, accessories, and installation instructions for each hydronic specialty and special-duty valve specified.

1. Submit flow and pressure drop curves for diverting fittings and calibrated plug valves, based on manufacturer's testing.

C. Shop Drawings detailing pipe anchors, special pipe support assemblies, alignment guides, and expansion joints and loops.

D. Field test reports indicating and interpreting test results for compliance with performance requirements specified in Part 3 of this Section.

E. Maintenance data for hydronic specialties and special-duty valves to include in the Operation and Maintenance Manual specified in Division 23 Section “Basic Mechanical Requirements.”

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with the following provisions:

1. ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
2. Fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
3. Welding Standards: Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."

1.6 COORDINATION

A. Coordinate layout and installation of piping with equipment and with other installations.

B. Coordinate pipe sleeve installation for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in other Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete housekeeping pads. Cast anchor-bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Firestopping" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Circuit Setter Valve:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Flow Design, Inc.
d. Gerand Engineering Co.
e. HCi.
f. ITT Fluid Technology Corp.; ITT Bell & Gossett.
g. MEPCO

h. Tour and Andersson.
i. Taco; Fabricated Products Div.
j. Watts Regulator Co.

2. Pump Discharge Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. ITT Fluid Technology Corp.; ITT Bell & Gossett.
d. Taco; Fabricated Products Div.

3. Pressure-Reducing Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Grinnell Supply Sales Co.
d. ITT Hoffman; ITT Fluid Handling Div.
e. Watts Industries, Inc., Watts Regulator
f. Wilkins.

4. Safety Relief Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Conbraco Industries, Inc.
d. ITT Fluid Technology Corp.; ITT McDonnell & Miller.
e. Kunkle Valve Division
f. Spence Engineering Company, Inc.

5. Diaphragm-Type Compression Tanks:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.

6. Air Separators:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. ITT Fluid Technology Corp.; ITT Bell & Gossett.
d. Patterson Pumps
e. Taco; Fabricated Products Div.

7. Air Vents (manual and automatic):

a. Armstrong Pumps, Inc.
b. Bell & Gossett ITT; Fluid Handling Div.
c. Hoffman Specialty ITT; Fluid Handling Div.
d. Spirax Sarco.

8. Pump Suction Diffusers:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett ITT; Fluid Handling Div.
    d. Mueller.
    e. Taco; Fabricated Products Div.
    f. Victaulic Company of America

9. Pattern Strainers:

    a. Armstrong Machine Works.
    b. Associated Piping Equipment.
    c. Hoffman Specialty ITT; Fluid Handling Div.
    d. Metraflex Co.
    e. Mueller.
    f. Spirax Sarco.
    g. Trane Co.
    h. Victaulic Co. of America.
    i. Watts Regulator Co.

2.2 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3 "Pipe Applications" Article for identifying where the following materials are used.

B. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

C. Steel Pipe, 4 Inch and Smaller: ASTM A53F, schedule 40, plain ends.

2.3 FITTINGS

A. Wrought-Copper Fittings: ASME B16.22.

B. Wrought-Copper Unions: ASME B16.22.

C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300.

D. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-Iron Threaded Flanges: ASME B16.1, Classes 125 and 250; raised ground face, bolt holes spot faced.

G. Wrought-Steel Fittings: ASTM A 234 (ASTM A 234M), Standard Weight.

H. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

I. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig (1035-kPa) minimum working pressure, 250 deg F (121 deg C) maximum operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected and shall be capable of 3/4-inch (20-mm) misalignment.

J. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body, steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F (121 deg C) and pressures up to 150 psig (1035 kPa).

2.4 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

B. Brazing Filler Metals: AWS A5.8, Classification BAg 1 (silver).

C. Welding Materials: Comply with Section II, Part C of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

D. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 VALVES

A. Valves are specified in Division 23 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for specific uses and applications for each valve specified.

C. Circuit Setter Valves: 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature, bronze body, plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2-inch NPS (DN50) and smaller shall have threaded connections and 2-1/2-inch NPS (DN65) valves shall have flanged connections.

2.6 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig (1035-kPa) working pressure, 225 deg F (107 deg C) operating temperature; manually operated with screwdriver or thumbscrew; with 1/8-inch NPS (DN6) discharge connection and 1/2-inch NPS (DN15) inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig (1035-kPa) working pressure, 240 deg F (116 deg C) operating temperature; with 1/4-inch NPS (DN8) discharge connection and 1/2-inch NPS (DN15) inlet connection.

C. Diaphragm-Type Compression Tanks: Welded carbon steel for 125-psig (860-kPa) working pressure, 375 deg F (191 deg C) maximum operating temperature. Separate air charge from system water to maintain design expansion capacity, by a flexible diaphragm securely sealed into tank. Provide taps for pressure gage and air-charging fitting, and drain fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Fabricate and test tank with taps and supports, and label according to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

D. Pump Suction Diffusers: Cast-iron body, with threaded connections for 2 inch and smaller, flanged connections for 2-1/2 inch and larger; 175 psig working pressure, 300 deg F maximum operating temperature; and complete with the following features:

1. Inlet vaines with length 2-1/2 times pump suction diameter or greater.
2. Cylinder strainer with 3/16 inch diameter openings with total free area equal to or greater than 5 times cross-sectional area of pump suction, designed to withstand pressure differential equal to pump shutoff head.
3. Disposable fine mesh strainer to fit over cylinder strainer.
4. Permanent magnet, located in flow stream, removable for cleaning.
5. Adjustable foot support, designed to carry weight of suction piping.
6. Blowdown tapping in bottom; gage tapping inside.

E. Y-Pattern Strainers: 125-psig (860-kPa) working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for 2-1/2-inch NPS (DN65) and larger, threaded connections for 2-inch NPS (DN50) and smaller, bolted cover, perforated Type 304 stainless-steel basket, and bottom drain connection.

F. T-Pattern Strainers: 750-psig (5170-kPa) working pressure; ductile-iron or malleable-iron body, grooved end connections, Type 304 stainless-steel strainer basket with 57 percent free area; removable access coupling and end cap for strainer maintenance.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS

A. Hot Water, 2-Inch NPS (DN50) and Smaller: Aboveground, use Type L (Type B) drawn-temper copper tubing with soldered joints or steel pipe with threaded joints.

B. Hot and Chilled Water, 2-1/2-Inch NPS (DN65) and Larger: Steel pipe with welded and flanged joints.

C. Condensate Drain Lines: Type L (Type B) drawn-temper copper tubing with soldered joints or Schedule 40 PVC pipe with solvent-welded joints. (PVC pipe is not allowed in return air plenums).

D. The contractor may at his option deviate from the breakpoint indicated of 2” and Smaller 2-1/2” and Larger, provided that all pipe and fittings of one particular size and larger (or smaller as applicable) shall be of the same material.

3.2 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Use gate, ball, and butterfly valves.

B. Install shutoff-duty valves at each branch connection to supply mains, at supply connections to each piece of equipment, and elsewhere as indicated.

C. Install circuit setter valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.

D. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

E. Install check valves on each pump discharge and elsewhere as required to control flow direction.

F. Install pump discharge valves with stem in upward position. Allow clearance about stem for check mechanism removal.

G. Install pressure-reducing valves on hot water generators and elsewhere as required to regulate system pressure.

3.3 PIPING INSTALLATIONS

A. Install piping according to Division 23 Section "Basic Mechanical Materials and Methods."

B. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch NPS (DN20) ball valve, and short 3/4-inch NPS (DN20) threaded nipple and cap.

D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

F. Install branch connections to mains using tee fittings in main with takeoff out bottom of main, except for up-feed risers with takeoff out top of main line.

G. Install unions in pipes 2-inch NPS (DN50) and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required at flanged connections.

H. Install flanges on valves, apparatus, and equipment having 2-1/2-inch NPS (DN65) and larger connections.

I. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.

J. Install strainers on supply side of each control valve, pressure-reducing valve, pressure-regulating valve, solenoid valve, in-line pump, and elsewhere as indicated. Install 3/4-inch NPS (DN20) nipple and ball valve in blow-down connection of strainers 2-inch NPS (DN50) and larger.

K. Anchor piping to ensure proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

A. General: Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Conform to requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) in length.
2. Adjustable roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal runs 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following minimum rod sizes and maximum spacing:

1. 3/4-Inch NPS (DN20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
2. 1-Inch NPS (DN25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
3. 1-1/2-Inch NPS (DN40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
4. 2-Inch NPS (DN50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
5. 2-1/2-Inch NPS (DN65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
6. 3-Inch NPS (DN80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
7. 4-Inch NPS (DN100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).

D. Install hangers for drawn-temper copper piping with the following minimum rod sizes and maximum spacing:

1. 3/4-Inch NPS (DN20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. 1-Inch NPS (DN25): Maximum span, 6 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
3. 1-1/2-Inch NPS (DN40): Maximum span, 8 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
4. 2-Inch NPS (DN50): Maximum span, 8 feet (3 m); minimum rod size, 3/8 inch (10 mm).
5. 2-1/2-Inch NPS (DN65): Maximum span, 9 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
6. 3-Inch NPS (DN80): Maximum span, 10 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).

E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's recommendations for service conditions. Avoid point loading. Space and install hangers with the least practical number of rigid anchor points.

F. Support vertical runs at each floor and at 10’ intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC and CPVC piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in system, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points in system, heat-transfer coils, and elsewhere as required for system air venting.

C. Install diaphragm-type compression tanks on floor as indicated. Vent and purge air from hydronic system, and charge tank with proper air charge to suit system design requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Piping size for supply and return shall be same size as equipment connections.

B. Install control valves in accessible locations close to equipment.

C. Install pressure gage at coil inlet connections.

3.8 FIELD QUALITY CONTROL

A. Testing Preparation: Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment that is not subjected to test pressure from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Flanged joints where blinds are inserted to isolate equipment need not be tested.
5. Install relief valve set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Testing: Test hydronic piping as follows:

1. Use ambient temperature water as testing medium, except where there is risk of damage due to freezing. Another liquid may be used if it is safe for workers and compatible with piping system components.
2. Use vents installed at the high points of system to release trapped air while filling system. Use drains installed at low points for complete removal of liquid.
3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low-pressure filling lines are disconnected.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Check to verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.9 ADJUSTING AND CLEANING

A. After completing system installation, including outlet fittings and devices, inspect finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Flush hydronic piping systems with clean water. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

C. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

D. Chemical Treatment: Provide 30% concentration by volume inhibited ethylene glycol solution to filled chilled water system and heating water system. Provide a water analysis prepared by chemical treatment supplier to determine type and level of chemicals required to prevent scale and corrosion. Perform initial treatment after completing system testing.

3.10 SYSTEM START-UP

A. Fill system and perform initial chemical treatment.

B. Check expansion tanks to determine that they are not air bound and that system is completely full of water.

C. Perform these steps before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

END OF SECTION 23 2113

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes the following categories of hydronic pumps for hydronic systems:

1. Vertical in-line pumps.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: Include certified performance curves and rated capacities; shipping, installed, and operating weights; furnished specialties; final impeller dimensions; and accessories for each type of product indicated. Indicate pump's operating point on curves.

C. Shop Drawings: Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Maintenance Data: For pumps to include in maintenance manuals specified in Division 23 Section “Basic Mechanical Requirements.”

1.4 QUALITY ASSURANCE

A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

B. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 23 Section “Basic Mechanical Requirements” for “Substitutions.”

C. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 23 Section “Basic Mechanical Materials and Methods.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Vertical In-Line Pumps:

a. Armstrong Pumps, Inc.
b. Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
c. Goulds Pumps, Inc.
d. Grundfos Pumps Corp.
e. Patterson Pumps
f. Taco; Fabricated Products Div.

2.2 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.

C. Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B, if efficiency is not indicated.

2.3 VERTICAL IN-LINE PUMPS

A. Description: Vertical, in-line, centrifugal, flexible-coupled, single-stage, radially split case design. Include vertical-mounting, bronze-fitted design and mechanical seals rated for 125-psig (860-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C).

1. Casing: Cast iron, with threaded companion flanges for piping connections smaller than NPS 3 (DN80), drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.

2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.
3. Wear Rings: Replaceable, bronze casing ring.
4. Shaft and Sleeve: Ground and polished stainless-steel shaft with bronze sleeve.
5. Shaft: Ground and polished stainless-steel shaft with axially split spacer coupling.
6. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
7. Seals: Stuffing box, with at least four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
8. Motor: Directly mounted to pump casing and with lifting and supporting lugs in top of motor enclosure.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle or straight pattern, 175-psig (1200-kPa) pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory- or field-fabricated support.

B. Triple-Duty Valve: Angle or straight pattern, 175-psig (1200-kPa) pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps according to manufacturer's written instructions.

1. Install pumps according to HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

C. Support pumps and piping separately so piping is not supported by pumps.

D. Suspend in-line pumps using continuous-thread hanger rod and vibration-isolation hangers.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install suction diffuser and shutoff valve on suction side of vertical in-line pumps.

F. Install triple-duty valve on discharge side of vertical in-line pumps.

G. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.

H. Electrical: Refer to Section 23 0510 “Basic Mechanical Requirements” for electrical connections to mechanical equipment.

3.4 SYSTEM START-UP

A. Verify that pumps are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

C. Perform the following preventive maintenance operations and checks before starting:

1. Lubricate bearings.
2. Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
3. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
4. Check suction piping connections for tightness to avoid drawing air into pumps.
5. Clean strainers.
6. Verify that pump controls are correct for required application.

D. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:

1. Prime pumps by opening suction valves and closing drains, and prepare pumps for operation.
2. Start motors.
3. Open discharge valves slowly.
4. Check general mechanical operation of pumps and motors.

E. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.

F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 23 2123

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Reverse-flow option (for heat-pump applications).
6. End Connections: Socket, flare, or threaded union.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, tubing and wrought-copper fittings with brazed joints.

B. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

N. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multi floor vertical runs at least at each floor.

3.5 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.6 ADJUSTING

A. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

B. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

D. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 sections contain requirements that relate to this section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Mechanical Insulation” for duct insulation.
4. “Duct Accessories” for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
5. “Air Terminals” for constant-volume and variable-air-volume control boxes, and reheat boxes.
6. “Air Outlets and Inlets.”
7. “Testing, Adjusting, and Balancing” for air balancing and final adjusting of manual-volume dampers.

1.2 SUMMARY

A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.4 SYSTEM DESCRIPTION

A. The duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. General: Submit the following in accordance with the Conditions of Contract and Division 23 Section "Basic Mechanical Requirements."

B. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:

1. Sealing Materials.
2. Fire-Stopping Materials.
3. Round and Oval Spiral Duct Fittings
4. Ductwork Connection Systems

C. Shop Drawings from duct fabrication shop, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as the contract drawings, detailing:

1. Fabrication, assembly, and installation details, including plans elevations, details of sections, components, and attachments to other work.
2. Duct layout indicating pressure classifications and sizes on plans. For exhaust duct systems, indicate the classification of the materials handled as defined in this section.
3. Fittings.
4. Reinforcement and spacing.
5. Seam and joint details.
6. Penetrations through fire-rated and other partitions.
7. Terminal unit, coil, and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

D. Coordination Drawings for ductwork installation in accordance with Division 23 Section "Basic Mechanical Requirements." In addition to the requirements specified in "Basic Mechanical Requirements" show the following:

1. Coordination with ceiling suspension assembly members.
2. Spatial coordination with other systems installed in same space as duct systems.
3. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
4. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E. Welding Certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

G. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

H. Maintenance data for volume control devices, fire dampers and smoke dampers, in accordance with Division 23 Section "Basic Mechanical Requirements."

1.6 QUALITY ASSURANCE

A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."

B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current

C. NFPA Compliance: Comply with the following NFPA Standards:

1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.
2. NFPA 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations" Chapter 4, "Duct Systems," for kitchen hood duct systems, except as indicated otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Foamed-in-Place Fire Stopping Sealants:

a. STI (Specified Technologies, Inc.)
b. 3M Fire Protection Products
c. IPC (International Protective Coatings Corp.)

2. One-Part Fire Stopping Sealants:

a. STI (Specified Technologies, Inc.)
b. 3M Fire Protection Products
c. IPC (International Protective Coatings Corp.)

3. Spiral Duct and Fittings:

a. Norlock Metal Products Co.
b. Semco Mfg. Inc.
c. United Sheet Metal
d. Wesco
e. Wichita Sheet Metal Supply, Inc.

4. PVC Coated Spiral Duct and Fittings: (Exhaust Ductwork)

a. Norlock Metal Products Co.
b. Semco Mfg. Inc.
c. United Sheet Metal
d. Wesco

5. Ductwork Connection Systems (Contractor’s option):

    a. Ductmate Industries, Inc.

2.2 SHEET METAL MATERIALS

A. Sheet Metal, General: Provide sheet metal in gauges as called for in the 1985 Edition, 12th printing 1994, of "HVAC Duct Construction Standards" as published by SMACNA.

B. Galvanized Sheet Metal: Lock-forming quality, ASTM A-527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

C. PVC-Coated Galvanized Steel: UL-181 Class 1 Listing. Lock-forming quality galvanized sheet steel with ASTM A-527, Coating Designation G 90.

1. Fume-handling Applications: Provide with factory applied 4 mil coating on exterior and interior of ductwork.
2. Underground Applications: Provide with factory applied 4 mil coating on exterior and 1 mil coating on interior of ductwork. Ductwork shall be factory-corrugated for strength.

D. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

E. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.

F. Refer to Part 2 Section “Rectangular Duct Fabrication” for reinforcement of ductwork constructed under this section.

G. Provide materials which are free of visual imperfections such as pitting, seam marks, roller marks, stains and discolorations.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.

C. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.

D. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant FSTT-S-001657, Type I; formulated with a minimum of 75 percent solids.

E. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.4 FIRE-STOPPING

A. Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Resistant Sealant: Provide one-part elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or hot dipped galvanized rods with threads painted after installation.
2. Straps and Rod Sizes: Comply with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition for sheet steel width and gauge and for steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36.

1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.6 RECTANGULAR DUCT FABRICATION

A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with the 1985 Edition, 12th printing 1994 of "HVAC Duct Construction Standards" as published by SMACNA, Tables 1-3 through 1-18 and all related details. Reinforcement of duct systems through the use of metal shapes, tie rods, cross breaking or beading, etc., shall be done in accordance with applicable SMACNA standard details.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Fabricate retactangular ducts such that drawing dimensions reflect clear inside diminsions of duct with or without internal liner.

B. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

1. Supply Ducts: 3-inch water gage.
2. Return Ducts: 2-inch water gage, negative pressure.
3. Exhaust Ducts: 2-inch water gage, negative pressure.

C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA “HVAC Duct Construction Standard,” Figure 1-4 unless ducts are lined or are externally insulated.

2.7 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 1985 Edition, Figures 2-1 through 2-10.

2.8 ROUND AND FLAT-OVAL DUCT FABRICATION

A. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given size of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 Feet. Duct fabrication shall comply with 1985 Edition, 12th printing 1994, "HVAC Duct Construction Standards," as published by SMACNA.

B. Round Ducts: Fabricate supply ducts with spiral lockseam type construction of galvanized steel sheets. Round duct gauges shall be in accordance with SMACNA Table 3-2.

C. At Contractor's option, "Snap-Lock" round duct may be used for branch taps to diffusers for low pressure applications in sizes 12" and smaller. Duct construction shall comply with SMACNA Fig. 3-1 and Table 3-3.

D. Flat-Oval Ducts: Fabricate flat oval supply ducts with spiral lock seam type construction of galvanized sheet steel. Flat oval duct gauges shall be in accordance with SMACNA, Table 3-4.

E. Acid-Resistant Ducts: Provide factory-fabricated spiral ducts and fittings only; no shop or field fabrication will be allowed. Refer to PVC-Coated Galvanized Steel Sheets in this Section for materials.

2.9 ROUND AND FLAT-OVAL SUPPLY AND EXHAUST FITTING FABRICATION

A. Fittings shall be of the wall thickness two gauges heavier than shown for spiral seam gauges.

B. Fittings subject to less than 4" W.G. shall be spot welded and internally sealed air tight.

C. Fittings subject to 4" W.G. and greater shall be fully welded. All welded seams shall be painted.

1. Take-off Fittings: 90 degree tees or 45 degree laterals, cut-in saddle-tap take-offs with 1/2 inch flange turned out or full barrel type.

D. Elbows: Provide elbow types for sizes listed below. Fabricate the bend radius 1.5 times the

1. Elbows for use with spiral ductwork:

a. Round Elbows 12 inches and smaller: 2-piece, die-stamped.
b. Round Elbows Larger Than 12 inches: Standard gore construction.
c. Two-piece mitered elbows shall be complete with turning vanes.

2. Elbows for use with snap-lock ductwork:

a. Round Elbows 12 inches and smaller: Adjustable elbows.

E. PVC-Coated Elbows and Fittings: Provide factory-fabricated elbows and fittings only as listed below. Refer to PVC-Coated Galvanized steel sheets in this section for materials.

1. Round Elbows 12 Inches and Smaller: 2-piece, die stamped.
2. Round Elbows Larger Than 12 Inches: Standard gore construction.
3. Other Fittings: Riveted and bonded joints.
4. Couplings: Slip-joint construction with a minimum of a 2-inch insertion length.
5. Fittings shall be factory riveted or button punched and sealed internally on all seams and exposed rivets with #8 PVC sealant.

2.10 DUCTWORK CONNECTION SYSTEMS

A. General: Provide manufactured ductwork connection systems which have been tested and certified to meet the requirements of SMACNA. Provide all components and accessories to make a complete system. Include appropriate gaskets and sealants.

B. Rectangular Duct Connector Systems:

1. Provide 24 gauge roll-formed, galvanized steel angle with integral sealant for use on duct gauges from 26 GA. through 16 GA. (Ductmate '35' or approved equal).

C. Round Duct Connector Systems (10 inches through 72 inches):

1. Provide mating connector flanges and closure ring of roll-formed galvanized steel with integral sealant. (Ductmate Spiralmate or approved equal).
2. Provide appropriate mastic and neoprene gaskets.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.

B. Install ducts with fewest possible joints.

C. Use shop fabricated fittings or premanufactured duct connector systems for all changes in directions, changes in size and shape, and connections.

D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

H. Install insulated ducts with 1-inch clearance outside of insulation.

I. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

J. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

M. Fire-Rated Partition Penetrations: Where ducts pass through interior fire-rated partitions the penetration shall be properly protected. Provide mounting angles for the fire dampers as required by fire damper manufacturer to meet U.L. listing.

3.2 PVC-COATED DUCT INSTALLATION

A. Install PVC-coated duct and fittings according to manufacturer's written instructions.

B. Seal all joints and seams. Apply sealer to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

C. Secure couplings with sheet metal screws. Install screws at an interval of 12 inches (300 mm), with a minimum of three screws in each coupling.

D. Repair damage to PVC coating with manufacturer's recommended materials.

E. Connecting joints shall be sealed with applicable type hardcast and adhesive or equivalent.

3.3 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints as follows:

B. Pressure Classifications Greater Than 3 Inches Water Gage: All transverse joints, longitudinal seams, and duct penetrations.

C. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams.

1. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only.

D. Seal externally insulated ducts prior to insulation installation.

3.4 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards, Tables 4-1 through 4-3 and Figures 4-1 through 4-8.

B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding one-fourth of failure (proof-test) load, but are not limited to the specific methods indicated.

E. Install concrete inserts before placing concrete.

F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3.5 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Branch Connections: Comply with SMACNA's "HVAC Duct Construction Standards," Figures 2-7 and 2-8.

C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.

D. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figure 2-19.

3.6 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

B. Conduct tests, in presence of Engineer, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give (7) seven days' advance notice for testing.

C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.

D. Maximum Allowable Leakage: As described in ASHRAE 2001 Handbook, "Fundamentals" Volume, Chapter 34, Table 6 and Figure 14. Comply with requirements for leakage classification 3 for round and flat oval ducts, leakage classification 12 for rectangular ducts in pressure classifications less than and equal to 2 inches water gage (both positive and negative pressures), and leakage classification 6 for pressure classifications greater than 2 inches water gage and less than and equal to 10 inches water gage.

E. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

F. Leakage Test: Perform volumetric measurements and adjust air systems as described in ASHRAE 1999 "HVAC Applications" Volume, Chapter 36 and ASHRAE 2001 "Fundamentals" Volume, Chapter 14, and Division 23 Section "Testing, Adjusting, and Balancing."

3.7 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for requirements and procedures for adjusting and balancing air systems.

B. The Contractor shall take all necessary precautions to protect the ductwork from a build-up of construction dust and debris. All openings in installed ductwork shall be sealed with a protective sheet plastic wrap. Should the duct system become contaminated with construction dust and debris, the Contractor, at his own expense, shall hand vacuum the interior of the duct system to the satisfaction of the Engineer.

END OF SECTION 23 3113

SECTION 23 3300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 and 28 Sections contain requirements that relate to this Section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Air Terminals” for constant-volume and variable-air-volume control boxes and reheat boxes.
4. “Air Outlets and Inlets.”

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Fire and smoke dampers.
4. Turning vanes.
5. Duct-mounted access doors and panels.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.
9. 45-Degree takeoffs.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:

1. Backdraft dampers and counterbalanced relief dampers.
2. Manual-volume dampers.
3. Fire and smoke dampers.
4. Duct-mounted access doors and panels.
5. Flexible ducts.
6. Turning vanes.
7. 45-Degree take-offs.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

1. Special fittings and manual- and automatic-volume-damper installations.
2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.

D. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

E. Maintenance data for each type of duct accessory required for inclusion in Operating and Maintenance Manual specified in Division 23 Section “Basic Mechanical Requirements.”

F. Damper Operational Test Records: Submit fire, smoke and fire/smoke damper operational test records as required by NFPA 90A, NFPA 80 and NFPA 105. Each damper shall be tested, any deficiencies corrected, retested if required and documented that the installation and operation meets the requirements of NFPA.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide duct accessories by one of the following:

1. Backdraft Dampers and Counterbalanced Relief Dampers:

a. Air Balance.
b. American Warming and Ventilating, Inc.
c. Arrow Louver and Damper.
d. Greenheck.
e. Louvers and Dampers.
f. Penn Ventilator Co.
g. Ruskin Mfg. Co.
h. Cesco Products.
i. P.H.L.

2. Manual Volume Control Dampers:

a. Air Balance.
b. American Warming and Ventilating, Inc.
c. Arrow Louver and Damper.

d. Cesco Products.
e. Greenheck.
f. Louvers and Dampers.
g. Penn Ventilator.
h. Ruskin Mfg. Co.
i. United Air.

3. Fire and Smoke Dampers:

a. Air Balance.
b. American Warming and Ventilation, Inc.
c. Arrow Louver and Damper.
d. Cesco Products.
e. Greenheck.
f. Louvers and Dampers, Inc.
g. Penn Ventilator.
h. Phillips - Aire.
i. Prefco Products, Inc.
j. Ruskin Mfg. Co.
k. United Air.

4. Turning Vanes:

a. Barber Colman Co.
b. Duro Dyne Co.
c. Sheet Metal Connectors, Inc.

5. Duct Access Doors/Panels:

a. Air Balance Inc.
b. Cesco Products.
c. Ductmate Industries, Inc.
d. Duro Dyne Corp.
e. Flexmaster.
f. Greenheck.
g. Ruskin Mfg. Co.
h. Semco Mfg., Inc.
i. Ventfabrics.

6. Flexible Connectors:

a. American/Elgen Co.
b. Duro Dyne Corp.
c. Flexaust.
d. Ventfabrics, Inc.

7. Flexible Ducts:

a. Flexmaster.
b. Thermaflex.

8. 45-Degree Takeoffs:

   a. Flexmaster.
   b. Sheet Metal Connectors, Inc.

2.2 BACKDRAFT DAMPERS

A. General: Provide factory-fabricated backdraft dampers, complete with required hardware and accessories. Damper frame and blades to be fabricated from a minimum of .064 thick 6063-T6 extruded aluminum with blade shafts rotating in heavy walled, self-lubricating nylon bearings. Shafts shall be permanently secured to blades that are PVC gasketed. Damper shall be able to handle maximum spot velocities to 2500 FPM on a 36" wide unit and start to open at a minimum of .05" WG.

B. Dampers shall be coordinated for horizontal or vertical installation depending on application.

   1. Provide Cesco model BDA or equivalent.

C. Provide extruded aluminum mounting flange secured to damper frame.

2.3 MANUAL-VOLUME DAMPERS

A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft. Provide concealed damper operators when above hard ceilings.

B. Manual Volume Dampers (12 inches and less): Shall be single blade type constructed of 18 gauge galvanized steel frames with 20 gauge galvanized steel blades, 3/8" cadmium plated shafts and factory furnished hand quadrant locks. Damper shall be suitable for operation up to 1.0" pressure differential and a maximum velocity of 2000 fpm.

   1. Provide Greenheck Model MBD-10 or equivalent.

C. Manual Volume Dampers (above 12 inches high): Shall be opposed blade type constructed of 16 gauge galvanized steel frames with 16 gauge galvanized steel blades, 1/2" cadmium plated round control shafts and factory furnished hand quadrant locks. Damper shall be suitable for 2.0" pressure differential at a damper width of 48" and 4.0" at a damper width of 12" and a maximum velocity of 2000 fpm.

   1. Provide Greenheck Model MBD-15 or equivalent.

D. Round Manual Volume Dampers (Maximum 24" Diameter): Shall be single blade type constructed of 20 gauge galvinized steel frames with 20 gauge galvanized steel blades, 3/8" plated steel control shafts and factory furnished hand quadrant locks. Damper shall be suitable for 1.0" pressure differential and a maximum velocity of 2000 fpm.

   1. Provide Greenheck Model MBDR-50 or equivalent.

E. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within a pipe bearing assembly mounted on supports at each mullion and at each end of multiple damper assemblies. Provide appropriate length and number of mounting to connect linkage of each damper of a multiple damper assembly.

F. Quadrant Locks: Zinc-plated, die-cast core with a heavy-gage dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Provide center hole to suit damper operating rod size. Provide elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. Provide curtain type dampers which are UL labeled, NFPA 90 approved in accordance with UL 555 standards.

B. Fire Rating: One and one-half and three hours (see drawings for requirements).

1. For use in dynamic and static systems

C. Dampers shall have 21 gauge galvanized steel rolled and formed frame and interlocking blades, with 1 1/2 hour low leakage rating.

D. Dampers shall have a replaceable fusible link rated at 165 degrees F.

E. Dampers shall have a replaceable fusible link rated at 212 degrees F.

F. Dampers shall be provided with factory manufactured steel sleeves and PFMA picture frame angles on both sides in accordance with manufacturer installation instructions and UL 555.

G. Dampers mounted in the horizontal position shall be provided with a blade lock and stainless steel negator closure spring.

H. Dampers for installation in round and oval ducts shall be equal to Greenheck type DFD style CR or CO, folding blade type, with 100% free area. Dampers for installation in low velocity rectangular ducts shall be equal to Greenheck type DFD style A, blades in air stream. Dampers for installation in medium velocity rectangular ducts shall be equal to Greenheck type DFD style B, 95% free area. Provide Greenheck type DFD210 style A dampers where Open/Closed indication is noted on the drawings.

I. Dampers for installation in round and oval ducts shall be Ruskin type DIBD series style LR or LO, folding blade type, with 100% free area. Dampers for installation in low velocity rectangular ducts shall be Ruskin type DIBD series style A, blades in the air stream. Dampers for installation in medium velocity rectangular ducts shall be Ruskin type DIBD series style B, 95% free area.

J. Dampers mounted in ducts shall have access door to service damper. Refer to paragraph in this section on access doors.

2.5 COMBINATION SMOKE/FIRE DAMPERS

A. Provide Class II combination dampers of multiblade construction with UL label according to UL Standard UL 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems," and with 1 1/2 hour and 3 hour UL labelled rating in accordance with UL 555 "Standard for Fire Dampers." All dampers, actuators and operators shall be seismic and fragility test rated.

1. Dynamic and static rated.
2. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
3. Fire Rating: 1-1/2 and 3 hours (see drawings for requirements).
4. Each damper/actuator combination shall an UL555S elevated temperature rating of 350°F minimum.

B. Dampers shall meet requirements for combination fire smoke dampers in accordance with:

1. NFPA 90A, 92A, 92B, and 101.
2. CSFM Fire Damper Listing.
3. CSFM Leakage (Smoke) Damper Listing.
4. Applicable Building Codes.
5. Dampers shall bear the AMCA Certified Ratings Seal for Air Performance in accordance with AMCA 511.

C. Dampers shall be of very low leakage, no more than 10 cfm/sq ft at 1" w.g. after exposure to 850 degrees F for full non-heat degradable 30 minute rating. The required actuator torque to meet this rating shall not exceed 0 lb-in.

D. The damper's construction shall consist of a 16 ga. steel frame with 16 ga. steel blades that are strengthened by three longitudinal deep vee grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade stops shall occupy no more than ½" of the damper opening area to allow for maximum free area and to minimize pressure loss aross the damper.

1. Blade Seals shall be extruded silicone rubber permanently bonded to the appropriate blade edges.
2. Jamb seal shall be a flexible stainless steel compression type.
3. Axles shall be a minimum of 1/2-inch diameter plated steel.
4. Damper linkage shall be concealed in the jamb.
5. Axle bearings shall be sintered bronze sleeve type rotating in polished extruded holes in the damper frame.
6. Dampers shall be rated for mounting vertically (with blades running horizontally) or horizontally.

E. Combination Smoke/Fire Dampers shall be installed in accordance with the manufacturers UL installation instructions and shall be equal to Greenheck FSD212 (1.5 hr) or FSD231 (3 hr).

1. Dampers shall be provided with factory manufactured steel sleeves and picture frame angles on both sides in accordance with manufacturer installation instructions and UL 555.
2. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application. Thickness as required by UL based on duct dimension and connection type (Rigid or Breakaway), but not less than the duct thickness. Connections as approved by UL Standard 555. Provide factory-furnished silicone caulking at the joint between the damper frame and the duct/sleeve to prevent air leakage and maintain damper listing.
3. Each damper shall be provided with a RRL fixed temperature electric sensor with manual reset.
4. Provide the OCI open/closed indication where damper status is required on the drawings.

F. All electric actuations shall be 120V and UL labeled, equal to Greenheck OEM Honeywell ML4115 electric actuator.

1. Actuators shall be externally mounted.

G. Dampers mounted in ducts shall have access door to service damper. Refer to paragraph in this section on access doors.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible", Figures 2-2 thru 2-7.

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- (38-mm-) wide, curved blades set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into side strips suitable for mounting in ducts.

C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.7 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Provide access doors where required of construction and airtightness suitable for duct pressure class.

B. Frame: Provide min. 22 ga. galvanized, sheet steel, with bend-over tabs and PVC foam gaskets.

C. Door: Provide 24 ga. double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

D. Vision Panel: Provide a single pane plexiglass panel in access door to allow viewing into duct without removing door. Seal around glass panel with neoprene or PVC foam tape.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. General: Provide flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 214, “Tests for Flame Proprogation of Particle Films” and UL 181, Class 1, “Factory Made Air Ducts and Air Connectors.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric wide attached to two strips of 24 gauge thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA, HVAC Duct Standard, 1st Edition, Fig. 2-19.

1. Standard - 3" wide fabric with 3" wide metal on each side for 9" total width.
2. Extra-Wide - 6" wide fabric with 3" wide metal on each side for 12" total width.

C. Fabrics: Provide air-tight, water-tight, and fire retardant glass fabrics with appropriate coatings and characteristics for various applications as described.

1. Conventional, Indoor System Flexible Connector Fabric: Heavy fabric double coated with polychloroprene.

a. Minimum Weight: 30 oz./sq.
b. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
c. Provide Ventfabrics “Ventglas” or equal.

2. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.

a. Minimum Weight: 14 oz./sq. yd.
b. Tensile Strength: 300 lbf/inch in the warp, and 275 lbf/inch in the filling.
c. Provide Ventfabrics “Ventel” or equal.

2.9 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1, and/or Class 0, “Factory Made Air Ducts & Air Connectors and NFPA 90A and 90B.

B. Flexible Ducts - Insulated: Factory-fabricated insulated, round duct, with an outer jacket enclosing a 1-1/2 inch thick fiberglass insulating blanket with fiberglass scrim around a continuous inner liner.

1. Reinforcement: Coated steel wire helix permanently bonded to inner liner.
2. Outer Jacket: Polyethylene film.
3. Inner Liner: Polyethylene or CPE film.
4. Operating pressure from +6 inches to -1 inch.
5. Provide Thermaflex G-KM, Flexmaster Type 8 or approved equal.
6. Reinforcement: Coated steel wire helix permanently bonded to inner liner.
7. Outer Jacket: Fiberglass reinforced metalized film laminate.
8. Inner Liner: Polyethylene or CPE film.
9. Operating pressure from +10 inches to -1 inch.
10. Provide Thermaflex M-KF, Flexmaster Type 8M or approved equal.

C. Flexible Duct Clamps: Stainless steel band with cadmium plated hex screw to tighten band with a worm gear action. Provide in sizes to match duct sizes.

2.10 45-DEGREE TAKEOFFS

A. General: Sheet metal high efficiency takeoff with a rectangular opening, 45-degree slope on the body, and manual volume control damper with locking device.

B. Minimum 26-gauge galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install duct accessories according to Manufacturer’s installation instructions and applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Install volume dampers in lined duct with methods to avoid damage to and erosion of duct liner.

C. Provide flexible duct connections wherever ductwork connects to vibration producing equipment. Seal seams with manufacturers recommended bonding agent.

D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

1. Install fusible links in fire dampers.

E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

F. Label access doors according to Division 23 Section "Mechanical Identification."

G. Install flexible ducts to minimize air restrictions. The maximum allowable length of any flexible duct shall be 5 feet. Changes in direction 90 degrees or greater shall not be made with flexible duct.

H. Install turning vanes in square or rectangular 90 degrees elbows in supply, return, and exhaust air systems and elsewhere as indicated.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

D. Provide operational test and documentation of test for each fire, fire/smoke and smoke damper as required by NFPA 90A. Verify operation of each damper and submit documentation that each damper successfully passed the operational testing as required by NFPA 90A, NFPA 80 and NFPA 105.

END OF SECTION 23 3300

SECTION 23 3600 - AIR TERMINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Mechanical Insulation” for external insulation of air terminals.

1.2 SUMMARY

A. This Section includes the following:

1. Single-duct air terminals.
2. Air Valves

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: Include rated capacities; voltage; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated. Include a schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating air outlets with other items installed in ceilings.

E. Maintenance Data: List of parts for each type of air terminal and troubleshooting maintenance guide to include in the Operation and Maintenance Manuals specified in Division 23 Section “Basic Mechanical Requirements.”

1.4 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 23 Section "Basic Mechanical Requirements" for substitutions.

B. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

C. NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

D. Comply with NFPA 70 for electrical components and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide air terminals by one of the following:

1. VAV Boxes

a. E.H. Price
b. Titus.

2. Air Valves

a. Phoenix
b. CRC
c. E.H. PRice
d. Pre-Approved Equal

2.2 SINGLE-DUCT AIR TERMINALS (**HOT WATER HEATING COIL)**

A. Configuration: Volume-damper assembly inside unit casing. Locate control components inside protective metal shroud.

B. Casings: Steel sheet metal of the following minimum thicknesses:

1. Upstream Pressure Side: 0.0239-inch (0.6-mm) steel.
2. Downstream Pressure Side: 0.0179-inch (0.45-mm) steel.

C. Casing Lining: Minimum of 3/4-inch- thick, fiber free insulation, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.

1. Provide terminal units with double wall insulated construction where scheduled.

D. Plenum Air Inlets: Round stub connections for duct attachment.

E. Plenum Air Outlets: S-slip and drive connections.

F. Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

G. Volume Damper: Construct of galvanized steel with peripheral seal and self-lubricating bearings.

1. Maximum Damper Leakage: 3 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
2. Damper Position: Normally open.

H. Hot-Water Heating Coil: 1/2-inch (13-mm) copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

I. Controls: Damper operator, thermostat, and other devices compatible with temperature controls specified in Division 23 Sections. Devices shall be factory mounted.

J. Electronic Controls:

1. VAV Box: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor provide control with the following features:

a. Proportional plus integral control of room temperature.
b. Time-proportional reheat-coil control.
c. Occupied/unoccupied operating mode.
d. Remote reset of airflow or temperature set points.
e. Adjusting and monitoring with portable terminal.
f. Communication with temperature-control system specified in Division 23 Sections.

2. Air Valve: Air valves shall be provided with all controls factory mounted to provide airflow control. This included airflow measuring devices with an factory mounted integrated controller to allow for full control of the air valve and logic and capability to control other valves in the same zone to provide an airflow offset for pressure relationships. A minimum of one controller shall be provided per zone. Controller programming adjustments shall be capable of being accessed through direct connection to the controller, through any associated room pressure controller, and through a BACNet connection to the building management system. All control of the heating coil and space temperature shall be controlled by the building management system and not the air valve controller.

K. Airflow measuring:

1. VAV Boxes shall be provided with factory mounted multipoint air flow grid located at the duct inlet of the box
2. Air valves shall utilizing a venturi flow measuring system factory built into the configuration of the valve with factory mounted ports, tubing and pressure transducers.

2.3 SOURCE QUALITY CONTROL

A. Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."

B. Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminals level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards; and maintain sufficient clearance for normal service and maintenance.

B. Connect ductwork to air terminals according to Division 23 ductwork Sections.

3.2 CONNECTIONS

A. Install piping adjacent to air terminals to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

3.3 FIELD QUALITY CONTROL

A. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

3.5 SYSTEM START-UP

A. Verify that installation of each air terminal is according to the Contract Documents.

B. Check that inlet duct connections are as recommended by air terminal manufacturer to achieve proper performance.

C. Check that controls and control enclosure are accessible.

D. Verify that control connections are complete.

E. Check that nameplate and identification tag are visible.

F. Verify that controls respond to inputs as specified.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
2. Review data in the maintenance manuals. Refer to Division 23 Section "Basic Mechanical Requirements."
3. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION 23 3600

SECTION 23 3713 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 sections contain requirements that relate to this section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Metal Ductwork.”
4. “Testing, Adjusting and Balancing.”

1.2 SUMMARY

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:

1. Ceiling air diffusers.
2. Wall registers and grilles.
3. Floor registers and grilles.
4. Louvers.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section "Basic Mechanical Requirements."

B. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data and product data, in Operating and Maintenance Manuals specified in Division 23 Section "Basic Mechanical Requirements."

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 “Standard for Air Outlets and Inlets.”
2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets."
3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual."
4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters."
6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide air outlets and inlets of one of the following:

1. Diffusers

a. Anemostat Products Div.; Dymanics Corp. of America.
b. Carnes Co.; Div. of Wehr Corp.
c. E.H. Price
d. Hart & Cooley
e. J & J Register
f. Krueger Mfg. Co.
g. MetalAire
h. Titus Products Div.; Philips Industries, Inc.
i. Tuttle & Bailey; Div. of Interpace Corp.

2. Registers and Grilles

a. Anemostat Products Div.; Dymanics Corp. of America.
b. Carnes Co.; Div. of Wehr Corp.
c. E.H. Price
d. Hart & Cooley
e. J & J Register
f. Krueger Mfg. Co.
g. MetalAire
h. Titus Products Div.; Philips Industries, Inc.
i. Tuttle & Bailey; Div. of Interpace Corp.

3. Louvers

a. American Warming & Ventilating Inc.
b. Carnes Co.; Div. of Wehr Corp.
c. Dowco Corp.

d. Greenheck
e. Industrial Louvers, Inc.
f. Ruskin Mfg. Co.

2.2 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule.

2.3 WALL REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule.

2.4 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have maximum free area, and minimum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 23 3713

SECTION 23 5216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”
3. “Hydronic Piping” for connections to hot water heating system.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.

E. AGA design certificates, for information.

F. Maintenance Data: Include in the maintenance manuals specified in Division 23 Section “Basic Mechanical Requirements.” Include parts list, maintenance guide, and wiring diagrams for each boiler.

G. It shall be the contractor’s responsibility to complete all requirements of and obtain the first Operations Certificate from the State of Kansas Boiler Inspector; contact Mr. Donald Jenkins, Chief State Boiler Inspector, Industrial Safety and Health, Department of Human Resources, State of Kansas, 512 SW 6th Avenue, Topeka, KS 66606-1690, (785) 296-4379.

H. It shall be the contractor’s responsibility to complete all requirements of and obtain the Construction Permit from the State of Kansas Department of Health and Environment, Bureau of Air and Radiation, 1000 SW Jackson, Suite 310, Topeka, Kansas 66612-1366, Phone: (785) 296-1551

I. It shall be the contractor’s responsibility to complete the most current edition of CSD-1, Appendix C, Manufacturer’s/Installing Contractor’s Report as required by the Owner’s insurance company and receive written approval by a representative of the insurance company.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide electrically operated components 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. AGA Compliance: Design certified by AGA; tests and ratings according to AGA requirements.

C. ASME Compliance: Fabricate and label boilers to comply with the ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

D. Comply with NFPA 70 for electrical components and installation.

E. ASHRAE Compliance: Minimum steady state efficiency of boilers as prescribed by ASHRAE 90.1 “Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.”

F. CSD-1 Compliance: Boilers rated and accessories provided in compliance with the latest edition of ANSI/ASME CSD-1.

G. KBSA Compliance: Boilers rated and accessories provided in compliance with the latest edition of the “Kansas Boiler Safety Act, KSA 44-913 et. seq. Rules and Regulations.”

H. UL: Controls and safety devices shall be UL listed and labeled.

I. FM Compliance: Control devices and control sequences according to requirements of Factory Mutual System (FM).

1.4 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by the contractor for heat exchanger.

1. Warranty Period: Manufacturer's standard, but not less than 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide boilers by one of the following:

1. Sealed-Combustion Boilers:

a. Camus Hydronics Ltd.

2.2 PACKAGED UNITS

A. Description: Factory-assembled and -tested modules include combustion-air inlet chamber, prepurge and postpurge blower assembly, air-gas fuel control valve, combustion chamber, heat exchanger, and exhaust; with insulated jacket around module and unit-mounted electrical control panel with operation sequence indicator lights.

B. Type: Sealed-combustion, gas-fired, condensing-type hot-water boiler with capacities and accessories as scheduled.

C. Fuel: Natural gas.

2.3 HOT WATER BOILER TRIM

A. Relief Valve: Each hot water boiler shall also be provided with at least one ASME rated pressure safety relief valve of the automatic reseating type.

B. Gage: Combination water pressure and temperature.

C. Low-Water Cutoff: Automatic low water fuel cutoff with manual reset to prevent burner operation at low water level. Cutoff may be either a probe or float type. Provide all float type cutoffs with a McDonnell & Miller test vavle model TC-4 (upper and lower taps). Provide all probe type cutoffs with test button.

D. Operating Temperature Control: Electronic operating temperature controller maintains boiler water temperature with electronic primary and outdoor sensors. Reset ratio of outside air temperature change to discharge control point change adjustable from 1:2 to 100:1, with adjustable initial set point from 80 to 230 deg F (27 to 110 deg C). Mounted in NEMA 250 Type 1 wall-mounted enclosure with full cover.

E. High Limits: Each of the following shall have an independent sensing element and operating switch.

1. Temperature actuated control that will shut off the fuel supply to the boiler when the syetem water reaches a preset maximum operating temperature.
2. High temperature limit control that willkeep the water temperature from exceeding the maximum allowable temperature. Functioning of this control shall cause a safety lockout requiring manual reset.

2.4 ACCESSORIES

A. Include the following list of manufacturer's standard accessories:

1. Exhaust mufflers.
2. Air-supply mufflers.
3. Low-water cutoff and manual-reset high-limit control.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect boilers according to the ASME Boiler and Pressure Vessel Code, Section IV for low-pressure boilers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive boiler for compliance with requirements for installation tolerances and other conditions affecting boiler performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install boilers level and plumb, according to manufacturer's written instructions and referenced standards.

B. Install gas-fired boilers according to NFPA 54.

C. Support boilers on concrete pad per the requirements of Division 23 Section “Basic Mechanical Materials and Methods.” Cast anchor-bolt inserts into pad.

D. Assemble units and parts shipped loose or disassembled.

3.3 CONNECTIONS

A. Connect gas piping full size to boiler gas-train inlet with union.

B. Connect air-intake and exhaust piping to boiler, size as recommended by manufacturer. Use Schedule 40 CPVC pipe and fittings for exhaust, PVC for supply, with solvent-cemented joints. Pitch toward boiler minimum of 2 percent or as indicated. Provide termination as indicated.

C. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

D. Electrical: Refer to Section 23 0510 “Basic Mechanical Requirements” for electrical connections to mechanical equipment.

E. Condensate neutralizing set for boiler install.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to supervise the field assembly of components and installation of boilers, including piping and electrical connections. Report results in writing.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Hydrostatically test assembled boiler and piping, according to applicable sections of the ASME Boiler and Pressure Vessel Code.

3.5 CLEANING

A. Flush and clean boilers on completion of installation, according to manufacturer's written instructions.

B. After completing boiler installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes including chips, scratches, and abrasions with manufacturer's touchup paint.

3.6 SYSTEM START-UP

A. Engage a factory-authorized service representative to provide startup service.

B. Verify that installation is as indicated and specified.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment Installer.

C. Complete manufacturer's installation and startup checklist and verify the following:

1. Flue and chimney are installed without visible damage.
2. No damage is visible to boiler jacket, refractory, or combustion chamber.
3. Pressure-reducing valves are checked for correct operation and specified relief pressure. Adjust as required.
4. Clearances have been provided and piping is flanged for easy removal and servicing.
5. Heating circuit pipes have been connected to correct ports.
6. Labels are clearly visible.
7. Boiler, burner, and flue are clean and free of construction debris.
8. Pressure and temperature gages are installed.
9. Control installations are completed.

D. Ensure pumps operate properly.

E. Check operation of pressure-reducing valve on gas train, including venting.

F. Check that fluid-level, flow-switch, and high-temperature interlocks are in place.

G. Start pumps and boilers, and adjust burners to maximum operating efficiency.

1. Fill out startup checklist and attach copy with Contractor Startup Report.
2. Check and record performance of factory-provided boiler protection devices and firing sequences.
3. Check and record performance of boiler fluid-level, flow-switch, and high-temperature interlocks.
4. Run-in boilers as recommended or required by manufacturer.
5. Measure and record gas pressure on manifold.
6. Measure and record combustion-air temperature at inlet to burner.
7. Measure and record flue-gas temperature at boiler discharge.

H. Measure and record water flow rate, pressure drops, and temperature rise through each boiler.

I. Inspect expansion tank, makeup water meter, tank pressure, pressure-reducing valve, water level, and backflow preventer.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Operate boiler, including accessories and controls, to demonstrate compliance with requirements.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals.
4. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 23 5216

SECTION 23 7433 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes factory-assembled, dedicated outdoor air-handling units, including multiple components, capable of heating and cooling 100 percent outdoor air.

1.3 ACTION SUBMITTALS

A. Product Data: For each dedicated outdoor-air unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Certified fan-performance curves with system operating conditions indicated.
    b. Certified fan-sound power ratings.
    c. Fan construction and accessories.
    d. Motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each dedicated outdoor-air unit.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include detail mounting, securing, and flashing (if required).
4. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor/roof plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control reports.

E. Startup service reports.

F. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dedicated outdoor-air units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: **One** set(**s**) for each unit.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to replace components of dedicated outdoor-air units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Dedicated Outdoor-Air-Handling Units: One year from date of Substantial Completion.
2. Warranty Period for Compressors: **Five** years from date of Substantial Completion.
3. Warranty Period for Heat Exchangers: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an "NRTL" (nationally recognized testing laboratory), and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of units and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 and ASHRAE 34 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance:

1. Electric Coils: Comply with requirements in UL 1995.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Innovent
2. Greenheck
3. Trane

B. Source Limitations: Obtain dedicated outdoor-air units from single manufacturer.

2.3 MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, supply air blower, evaporator coil, heating water coil, packaged DX system, phase and brownout protection, motorized dampers, filter assembly intake air, supply air blower assembly, filter assembly, and an electrical DDC control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection

2.4 CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Outside casing: 22 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 22 gauge G60 galvaneal steel. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours.
2. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Rigid urethane foam

a. Thickness: 2 inch, R-13.
b. Meets UL94HF-1 flame requirements.
c. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.

C. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvannealed steel.

D. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

E. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material with a minimum of 2” inches in depth and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

F. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

G. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser fan shall have an external rotor motor with swept fan blades for low sound operation. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be digital hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

H. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

1. Global alarm condition (active when there is at least one alarm)
2. Supply Air Proving alarm
3. Dirty Filter Alarm
4. Compressor Trip alarm
5. Compressor Locked Out alarm
6. Supply Air Temperature Low Limit alarm

a. Sensor #1 Out of Range (outside air temperature)
b. Sensor #2 Out of Range (supply air temperature)
c. Sensor #3 Out of Range (cold coil leaving air temperature)

I. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

J. Hail Guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.

2.5 BLOWER

A. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.

D. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.6 MOTORS

A. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EP Act minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

2.7 UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors. This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.8 FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

2.9 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils are not to act as structural component of unit.

B. Supply-Air Refrigerant Coils:

1. Tubes: **Copper**.
2. Fins: **Aluminum**.
3. Fin and Tube Joints: Mechanical bond.
4. Headers: **Seamless-copper headers with brazed connections**.
5. Frames: **Galvanized steel**.
6. Coatings: **None**.
7. Ratings: Designed, tested, and rated in accordance with ASHRAE 33 and AHRI 410.

    a. Working Pressure: Minimum 300 psig.

C. Hot-Gas Reheat Refrigerant Coils:

1. Tubes: **Copper**.
2. Fins: **Aluminum**.
3. Fin and Tube Joints: Mechanical bond.
4. Headers: **Seamless-copper headers with brazed connections**.
5. Frames: **Galvanized steel**.
6. Coatings: **None**.
7. Ratings: Designed, tested, and rated in accordance with ASHRAE 33 and AHRI 410.

    a. Working Pressure: Minimum 300 psig.

8. Coating: **None**.
9. Suction-discharge bypass valve.

D. Heating-Water Coils: **Continuous circuit**.

1. Piping Connections: **Flanged**, **same end** of coil.
2. Tube Material: **Copper, 0.02" Thickness**.
3. Fin Type: Plate.
4. Fin Material: **Aluminum**.
5. Fin Thickness: **0.008" Thickness.**
6. Fin and Tube Joint: Mechanical bond.

7. Headers:

   a. Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
   b. Seamless copper tube with brazed joints, prime coated.
   c. Fabricated steel, with brazed joints, prime coated.
   d. Provide insulated cover to conceal exposed outside casings of headers.
   e. Frames: Channel frame, minimum 0.052-inch thick galvanized steel.
   f. Coil Working-Pressure Ratings: **200 psig, 325 deg F**.

8. Coating: **None**.

E. Condenser Refrigerant coils:

1. Tube Material: **Copper**.
2. Fin Material: **Aluminum**.
3. Fin and Tube Joint: Mechanical bond.
4. Coating: **None**.

2.10 REFRIGERATION CIRCUIT COMPONENTS

A. Compressors: Hermetic, **variable-speed** scroll compressors, mounted on integral vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief**, and crankcase heater**.

B. Refrigerant: **R-410A**.

C. 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. Thermostat for coil freeze-up protection during low-ambient-temperature operation or loss of air.
8. Brass service valves installed in discharge and liquid lines.
9. **Modulating** hot-gas reheat solenoid valve with a replaceable magnetic coil.

2.11 DAMPERS

A. Outdoor- and Relief-Air Dampers: Low-leakage, double-skin, airfoil-blade, **galvanized-steel** dampers with compressible jamb seals and extruded-vinyl blade edge seals with operating rods rotating in **sintered bronze or nylon** bearings mounted in a single **galvanized-steel** frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1 inch wg and 8 cfm/sq. ft. at 4 inches wg.

2.12 ELECTRICAL POWER CONNECTIONS

A. Single-Point Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a **single-point** field power connection to unit.

B. Factory Wiring: Branch power circuit to each motor and to controls with disconnecting means.

2.13 CONTROLS

A. Comply with requirements in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for control equipment and sequence of operation.

B. Control Valves: Comply with requirements in Section 230923.11 "Control Valves."

C. Control Wiring: Factory wire connection for controls' power supply.

D. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.

E. **Unit**-Mounted Status Panel:

1. Cooling/Off/Heating Controls: Control operational mode.
2. Damper Position: Indicate position of outdoor-air dampers in terms of percentage of outdoor air.
3. Status Lights:

    a. Filter dirty.
    b. Fan operating.
    c. Cooling operating.
    d. Heating operating.
    e. General alarm.

4. Digital Numeric Display:

    a. Outdoor dry-bulb temperature.
    b. Outdoor dew point temperature.
    c. Supply temperature.

F. Refrigeration System Controls:

1. Unit-mounted dry-bulb controller shall lock out refrigerant system when outdoor-air temperature is less than 55 deg F.
2. De-energizes dehumidifier operation when outdoor-air temperature is less than 55 deg F.

G. Rotary Heat-Exchanger Control:

1. Sequence with refrigeration system controls and heating controls.
2. For operation of rotary heat exchanger itself, see "Rotary Heat Exchanger" Article.

2.14 INTAKE AND RELIEF OPENINGS

A. Type: Manufacturer's standard hood or louver, including moisture eliminator, at all unit intake and relief openings.

B. Materials: Match material and finish of casing exterior.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Unit Support: Install unit level on concrete base, level and secure to rail supports. Coordinate exterior wall penetrations and flashing with existing wall construction. Secure units to structural rail support(s) with anchor bolts. Coordinate sizes and locations of rail supports with actual equipment provided.

B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

C. Connect duct to air-handling units with flexible connections.

D. Install separate devices furnished by manufacturer and not factory installed.

E. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 MECHANICAL PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to units, allow space for service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Hot-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping”. Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

E. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

3.4 MECHANICAL DUCT CONNECTIONS

A. Duct Connections:

1. Comply with requirements in Section 233113 "Metal Ducts."
2. Drawings indicate the general arrangement of ducts.
3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories."

3.5 ELECTRICAL CONNECTIONS

A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.7 STARTUP SERVICE

A. **Engage a factory-authorized service representative to perform** startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

    a. Alarms.

3. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
4. Start refrigeration system when outdoor-air temperature is within normal operating limits. and measure and record the following:

    a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
    b. Cooling coil entering-air, dry- and wet-bulb temperatures.
    c. Condenser coil entering-air dry-bulb temperature.
    d. Condenser coil leaving-air dry-bulb temperature.

5. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.

6. Inspect casing insulation for integrity, moisture content, and adhesion.
7. Verify that clearances have been provided for servicing.
8. Verify that controls are connected and operable.

9. Verify that filters are installed.
10. Clean coils and inspect for construction debris.
11. Inspect operation of power vents.
12. Inspect and adjust vibration isolators.
13. Verify bearing lubrication.
14. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
15. Start unit.
16. Inspect and record performance of interlocks and protective devices.
17. Operate unit for run-in period.
18. Calibrate controls.
19. Adjust and inspect high-temperature limits.
20. Inspect outdoor-air dampers for proper stroke.
21. Verify operational sequence of controls.
22. Measure and record the following airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Relief-air flow.
    c. Outdoor-air flow.

B. After startup, change filters AND verify bearing lubrication.

C. Remove and replace components that do not properly operate, and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.8 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.9 CLEANING

A. After completing system installation; testing, adjusting, and balancing dedicated outdoor-air unit and air-distribution systems; and completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, casings, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

3.11 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 7433

SECTION 23 8146.14 - VARIABLE REFRIGERANT FLOW, AIR SOURCE HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Heat recovery water source units
2. Mode change units
3. Fan coil units

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, furnished specialties, and accessories for each model.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which heat pumps are attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat pumps to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

B. Comply with NFPA 70.

C. Comply with safety requirements in UL 484 for assembly of free-delivery, air-source heat pumps.

D. Comply with safety requirements in UL 1995 for duct-system connections.

E. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

F. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

G. The installing contractor must have attended unit manufacturer’s installation training prior to installing the system.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VARIABLE REFRIGERANT FLOW, AIR SOURCE HEAT PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Samsung

2.2 HEAT RECOVERY AIR-SOURCE UNIT

A. General: The heat recovery air-source unit shall consist of the air-source unit, MCU's, indoor units, and Control Network Solution (Control systems). The air-source units shall be equipped with multiple circuit boards that interface to the Control Network Solution (Control systems) and shall perform all functions necessary for operation. The air-source unit shall have a powder coated finish. The air-source unit shall be completely factory assembled, piped, and wired. Each unit shall be run tested at the factory.

1. The heat recovery system shall have the following features:

a. Simultaneously heating and cooling operation modes on all indoor units when configured and installed as a heat recovery system.
b. Change operation mode (MAIN heating / MAIN cooling) without turning off the compressors allowing for constant heating and cooling operation.
c. Limit current (50% - 100% of design current) adjustable at air-source unit or central web accessible, control devices:
d. Shall have a sound rating no higher than 51 dB (A).
e. Allow adjustment of target evaporator coil temperatures in cooling mode and target heating discharge pressures depending on project conditions for heating and cooling calibration thus saving energy.
f. Shall have an accumulator with heater and controls.
g. Shall have a high-pressure safety switch, high voltage fuses, over-current protection, phase detection protection, low pressure protection, compressor overcurrent protection, current transformer(s), crank case heaters, and intelligent logic to ensure proper operation within unit design limitations and operational parameters.
h. Shall be cooled with liquid refrigerant circuit(s) to operate at optimal temperatures and to prevent failure due to overheating. No compressor inverter PCB's shall be cooled by air over heat sink. Cooling inverter components without air-cooling fins prevents failure due to environmental contaminants.
i. Shall be capable of operating in ambient temperatures between -1□F ~ 101□F.
j. Shall have high efficiency, individual oil separator(s) for each compressor plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
k. Unit shall have the ability to discharge inverter PCB capacitor voltage using service buttons on the air-source unit main PCB. The capacitor stored-voltage discharge feature shall allow safe inverter PCB replacement.
l. Unit shall have air-source unit pump-down operation capability allowing storage of refrigerant while opening sealed refrigerant pipe system outside of air-source unit chassis while performing service.
m. Shall have individual module pump-out operation capability allowing the majority of refrigerant in a air-source unit to be pumped out. The pump-out feature shall allow service of sealed refrigerant system within a air-source unit chassis.
n. Shall allow temporary disabling of individual compressors to allow system operation at reduced capacity after a compressor or compressor component related issue (when more than one compressor is present in system). Disabling of a compressor shall temporarily remove error codes and allow system operation.
o. In the event of system error due to air-source unit failure, the heat pump/heat recovery air-source unit shall display codes that specify a precise error and which air-source unit PCB is the cause.

B. All three refrigerant lines from the air-source unit to the MCU shall be insulated.

C. Unit Cabinet:

1. The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

D. Heat Exchanger:

1. The air-source unit heat exchanger shall be a stainless steel brazed plate heat exchanger.
2. Refrigerant flow from the air-source unit shall be controlled by means of capacity modulation capable, vapor injected, DC inverter, scroll compressor.

E. Compressor:

1. All compressors shall be modulation capable, direct vapor injected, DC inverter, scroll type.
2. Compressors shall be hermetically sealed, inverter driven, direct vapor injected, asymmetric, DC scroll type. No fixed capacity compressors shall be present in the refrigerant system.
3. Compressors shall have vapor injection capability to increase performance in both heating and cooling modes. This will be automatically enabled by the air-source unit(s) by forcing saturated refrigerant vapor directly into the scroll compression cycle increasing mass flow and overall system capacity. Compressors without vapor injection shall not be present in the VRF heat pump/heat recovery system.
4. Compressors shall have a soft-start function to reduce electricity demand during system start and to increase compressor reliability.
5. Crankcase heaters shall be factory mounted on the compressors.
6. The air-source unit compressor shall have variable modulation technology to modulate capacity.
7. The air-source unit compressor(s) shall have vapor injection technology which can increase the mass flow rate of refrigerant and offset refrigerant condensing temperatures resulting in a capacity and performance improvement in heating and cooling modes. Compressors without vapor injection shall not be present in the VRF heat pump/heat recovery system.
8. The compressor(s) will be equipped with an internal thermal overload.
9. The compressor(s) shall be mounted to avoid the transmission of vibration.

F. Electrical:

1. The air-source unit shall be controlled by integral microprocessors.
2. The control circuit between the indoor units, MCU and the air-source unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG, shielded cable to provide total integration of the system (F1/F2).

2.3 MODE CHANGE UNITS

A. General: The MCU (Mode Change Unit) shall be specifically used with R410A, heat recovery units. These units shall be equipped with a circuit board that interfaces to the control systems and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The MCU (Mode Change Unit) shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. The unit shall be mounted indoors. The air-source unit shall connect multiple MCU’s, up to 16 total per system.

B. Cabinet:

1. The chassis shall be fabricated of galvanized steel.
2. Each cabinet shall house multiple refrigeration control solenoid valves and electronic expansion valves.
3. Shall house six tube-in-tube sub cooling devices with electronic expansion valves and temperature sensors to maintain design refrigerant temperatures (sub cooling).

C. Refrigerant valves:

1. The unit shall be furnished with multiple two position solenoid valves.
2. When connecting a 36,000 btu/h or larger indoor unit section, two adjacent branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two refrigerant valves shall operate simultaneously. The MCU shall include the Y-joints necessary to connect 2 circuits or ports.
3. Electronic expansion valves and solenoid valves shall be used to control the variable refrigerant flow inside each MCU.

D. Electrical:

1. The MCU shall be controlled by integral microprocessors.
2. The control circuit between the indoor units, MCU and the air-source unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two conductor, 16 AWG, shielded cable.

2.4 FOUR-WAY CEILING CASSETTE FAN COIL UNIT

A. General: The 4-way cassette shall be recessed into the ceiling with a ceiling grille and shall have a modulating expansion device.

B. Indoor Unit:

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air (nitrogen gas) before shipment from the factory.
2. The indoor unit shall not have air louvers or blades allowing full airflow without restriction. Air direction controls shall be achieved by creating a low-pressure area near air outlet causing discharge air to change direction angle.

C. Unit Cabinet:

1. The cabinet shall be a ceiling-recessed cassette.
2. Construction shall be high impact polystyrene (HIPS) chassis with a galvanized steel frame and fascia panel certified to UL94 V0.
3. Each corner portion of the panel cabinet shall be detachable.
4. Branch ducting shall be allowed from cabinet, available on 2 sides to condition an adjacent area within a single room.
5. The indoor unit fascia panel shall have LED indicator lights on the front and an IR receiver for wireless controller use.

6. The cabinet shall have provisions for a field installed, filtered, outside air intake. A booster fan is necessary. A 12V DC relay terminal is available to control a booster fan (with a separate PCB connector).
7. The “ceiling type” fascia panel model PC4NUDMUN shall be square, white with a circular air outlet opening. This panel is designed for use in applications where the indoor unit chassis is recessed in the ceiling with a finished ceiling textile.

D. Fan:

1. The indoor fan assembly shall be a fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
4. The auto swing air outlet vanes (4) shall be capable of automatically swinging up and down for uniform air distribution.
5. The supply air vanes shall have independent control capability (32° – 65° control range) adjustable with wireless or wired controllers.
6. The cabinet shall have provisions for a field installed, filtered, outside air intake. A booster fan is necessary. A 12V DC relay terminal is available to control a booster fan (with a separate PCB connector).
7. The “ceiling type” fascia panel model PC4NUDMUN shall be square, white with a circular air outlet opening. This panel is designed for use in applications where the indoor unit chassis is recessed in the ceiling with a finished ceiling textile.

E. Filter:

1. Return air shall be filtered by means of a long-life washable permanent electro-static filter included with fascia panel.

F. Coil:

1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. Indoor unit shall have a built-in condensate pump as standard with a 29” maximum vertical lift.
7. Both refrigerant lines to the 4-way cassette indoor units shall be insulated.
8. Indoor unit shall have a built-in condensate float switch to disable the unit in the event of a condensate overflow.
9. Both refrigerant lines to the 4-way cassette indoor units shall be insulated.

G. Electrical:

1. The control circuit between the indoor units, MCU and the air-source unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG, shielded cable to provide total integration of the system (F1/F2).
2. The indoor unit PCB shall contain a time-lag fuse.
3. The indoor unit shall have a thermal fuse under high-voltage terminal block to disable unit in the event of overheating due to electrical malfunction/poor connection.

2.5 360 INDOOR CEILING CASSETTE FAN COIL UNIT

A. General: The 360 indoor ceiling cassette shall be a recessed into the ceiling with a ceiling grille and shall have a modulating expansion device.

B. Indoor Unit.

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air (nitrogen gas) before shipment from the factory.
2. The indoor unit shall not have air louvers or blades allowing full airflow without restriction. Air direction controls shall be achieved by creating a low-pressure area near air outlet causing discharge air to change direction angle.

C. Unit Cabinet:

1. The cabinet shall be space-saving, round, ceiling-recessed cassette with 360°, even air distribution.
2. Construction shall be high impact polystyrene (HIPS) chassis with a galvanized steel frame and fascia panel certified to UL94 V0.
3. Each corner portion of the panel cabinet shall be detachable, which gives easy access to adjust the height.
4. Branch ducting shall be allowed from cabinet, available on 2 sides to condition an adjacent area within a single room.
5. The indoor unit fascia panel shall have LED indicator lights on the front and an IR receiver for wireless controller use.
6. The cabinet shall have provisions for a field installed, filtered, outside air intake. A booster fan is necessary. A 12V DC relay terminal is available to control a booster fan (with a separate PCB connector).
7. The “ceiling type” fascia panel model PC4NUDMUN shall be square, white with a circular air outlet opening. This panel is designed for use in applications where the indoor unit chassis is recessed in the ceiling with a finished ceiling textile.

D. Fan:

1. The indoor fan shall be a turbo fan, direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
4. Fixed or auto swing air outlet/direction vanes (4) shall be capable of automatically swinging up and down for uniform air distribution and with a 10° – 60° angle range.
5. The supply air vanes shall have independent control capability (10° – 60° control range) adjustable with wireless or wired controllers.
6. Airflow direction indoor unit shall be accomplished without any air blades/louvers to remove air flow restrictions in the air outlet path. Instead, the cassette indoor unit shall use three (3) internal booster fans to create an area of low pressure outside of the air outlet opening causing the air to change direction.

E. Filter:

1. Return air shall be filtered by means of a long-life washable permanent electro-static filter included with fascia panel.

F. Coil:

1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. The coil fins shall be coated with hydrophilic paints.
6. A condensate pan, drain and drain pump shall be provided under the coil.
7. Indoor unit shall have a built-in condensate pump with check-valve as standard with a 29” maximum vertical lift above the condensate pan.
8. Indoor unit shall have a built-in condensate float switch to disable the unit in the event of a condensate overflow.
9. Both refrigerant lines to the one-way cassette indoor units shall be insulated.

G. Electrical:

1. The control circuit between the indoor units, MCU and the air-source unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG, shielded cable to provide total integration of the system (F1/F2).
2. The indoor unit PCB shall contain a time-lag fuse.
3. The indoor unit shall have a thermal fuse under high-voltage terminal block to disable unit in the event of overheating due to electrical malfunction/poor connection.

2.6 CONTROLS

A. General: The system controls consists of remote controllers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The control system shall support operation monitoring, scheduling, error monitor, power distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using BACnet interface.

B. Wiring:

1. Main system control wiring (COM1, F1/F2) shall be installed in a system daisy chain configuration from the indoor equipment to MAIN outdoor unit. This cable shall be 16 AWG X 2, shielded cable.
2. Zone control wiring (COM2, F3/F4) to wired remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit. This cable shall be 16 AWG X 2, shielded cable.
3. Control wiring for system controllers and centralized controllers (upper level) shall be installed in a daisy chain configuration from air-source unit to air-source unit (R1/R2), to system controllers.
4. Communication wire connection (OF1/OF2) between air-source unit modules (systems with 2 or more modules) must be connected from the MAIN unit to SUB1 and SUB2 (where applicable). This wire shall be 2-conductor, 16 AWG X 2, shielded cable.
5. Network wiring shall be CAT-5e with RJ-45 connection.
6. Software shall be capable of being networked with up to 16: (BACnet gateway), system controllers for web/LAN based control for consolidated control.

C. EEPROM:

1. All indoor units shall have a removable EEPROM on its PCB to store all unit data. All data on the unit EEPROM shall be viewable from the manufacturer provided service software. The unit main EEPROM shall be removable allowing replacement of unit PCB without losing digital, field programmed data. The unit removable EEPROM shall store the following unit data: unit model number, unit serial number, unit PCB firmware and MICOM version, and field programmed unit name/tag viewable on controls and service software.
2. All indoor units shall have addressing option settings that shall be done digitally; the indoor unit does not contain rotary dials or setting switches.
3. All indoor units shall have advanced unoccupied room control capability. Unoccupied room control shall be done with external contact control modules. The unoccupied settings can be modified with gateways or programmed with the manufacturer provided service software. Unoccupied room control shall include indoor unit ON/OFF, fan speed, and set temperature adjustment.

D. Multi-function controller – individual wired controller:

1. The wired controller shall control up to 16 indoor units (defined and controlled as one group).
2. The wired controller shall control indoor units as follows:

    a. Air handler operation ON/OFF
    b. Air handler operation mode, set temperature, air flow direction, fan speed, individual louver control (with supported indoor units), discharge air temperature (with supported indoor units)
    c. Quiet and sleep modes
    d. Error display
    e. Filter replacement alarm display and reset
    f. Single indoor unit control or multiple unit control (maximum 16 units)
    g. Energy saving operation:

        1) Upper/lower temperature setting
        2) Automatic operation stop function
        3) Energy saving operation mode
        4) Weekly operating schedule setting:

    h. Options to set: desired A/C operation mode, setting temperature, power mode (ON/OFF), and fan speed to operate based on weekly or daily schedules
    i. Optional schedule exception day setting

3. Other wired controller features:

    a. Different button permission levels
    b. Partial button lock option (on/off, selection, temperature setting, fan speed, and schedule setting buttons can be locked individually)
    c. Backlight
    d. Daylight savings clock advance option
    e. Upper and lower temperature setting restriction
    f. Auto mode skip
    g. Heat mode skip (cooling only)
    h. Restrict wireless controller signal (optional)
    i. Louver position setting (cassette and wall units)

j. Individual, individual louver/blade control for 4-way and mini 4-way cassettes.
k. Auto-off option to automatically turn the associated indoor unit(s) off after the specified time without any interaction with the wired controller.
l. System/indoor unit function and operation indication (defrost, error, restricted controller, SPi status)
m. Quiet Mode setting (for supported units)
n. Service mode for connected indoor unit operation monitoring, addressing, and setup
o. Can be used to specify "Mode Master" while connected to a single indoor unit when used with heat pump systems.
p. Real-time clock function - current time/day display function
q. Built-in room temperature sensor
r. Indoor unit operation state display
s. Service mode support (Indoor unit addressing, indoor unit cycle data monitoring, option code monitoring and setting, and option setting/monitoring)

4. Specifications:

a. 2 conductor connection, PLC, (F3/F4).
b. DC 12V (power supplied by indoor unit via F3/F4 connection).
c. RS485 communication (F3/F4).
d. Can sense temperature via internal sensor, temperature sensor inside the air handler, or use the average temperature between controller and air handler temperature sensors.
e. The wired controller shall have two screw terminals for wiring connections. Wire is not included with controller.
f. 16AWG X 2 shielded cable is necessary for proper operation.
g. The wired controller shall allow up to 328 feet of wire from the farthest connected indoor unit to the controller.

E. System management software:

1. The integrated management software shall be capable of controlling up to 4,096 indoor units.
2. Function:
3. The Integrated System Software shall enable the user to control multiple indoor units and shall provide additional functions.
4. The integrated management software shall be capable of connecting up to 16 controller.
5. The integrated management software shall be required if the user wants to simultaneously control 16 units from a single PC using a single software session.
6. The integrated management software shall support operation superseding that of the remote controllers, system configuration, daily/weekly/annual scheduling, monitoring of operation status, error email notification, online maintenance tool and malfunction monitoring.
7. The integrated management software shall have basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 4,096 indoor units), or all indoor units (collective batch operation). This basic control set of operation controls for the integrated management software shall include on/off, operation mode selection (cool, heat, auto, dry and fan), temperature setting, fan speed setting, airflow direction setting, energy distribution reporting with PDF export, and online maintenance.
8. The integrated management software provides centralized control, it shall be able to enable or disable operation of local remote controllers via PC.
9. The integrated management software shall also include a high-level security USB key.
10. In terms of scheduling, the integrated management software shall allow the user to define daily, weekly, and annual schedules with operations consisting of ON/OFF, mode selection, temperature setting, and permit/prohibit of remote controllers.

F. BACnet Gateway:

1. Control and monitoring through web browser (optimized for Internet Explorer). Individual/Group control of up to 256 indoor units.
2. The BACnet gateway shall have basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 256 indoor units), or all indoor units (collective batch operation). This basic control set of operation controls for the BACnet gateway shall include on/off, operation mode selection (auto, cool, heat, dry, and fan), temperature setting, fan speed setting, airflow direction setting, error email notification, temperature limitations, operation mode limitation, and online maintenance.
3. The BACnet gateway shall support system error notification via email. The Data Management Server emailed errors shall include: error occurrence time, error code with description of error, effected equipment address, and current error status.
4. The BACnet gateway shall support: system configuration, 1-day/daily/weekly scheduling, monitoring of operation status, online maintenance tool, operation superseding of the remote controllers, editable user defined control logic, and malfunction monitoring.
5. The BACnet gateway shall allow maximum current setting control of each air-source unit.
6. Schedule Control Function through web browser. Up to 256 schedule settings, weekly and daily schedule setting, wireless/wired remote controller restriction setting. Digital Outputs can be incorporated into scheduling.
7. The Server shall allow configuration of unoccupied room settings for indoor units configured for unoccupied room control.
8. Convenient digital display allows for easy set up.
9. SD memory card slot for data storage and software updating.
10. Available programmable logic to control the system based on preset monitor points.
11. Web Server Function with remote control (with a public IP address) via internet connection. No management software required – PC-independent management through web browser.
12. 10 DI (Digital Input) ports available. Two digital input ports shall be for emergency shutdown with external contact control interface and 8 for other monitoring options (OPEN/CLOSE status). Full indoor unit control with simple contact input (Emergency/Lock). Digital inputs can be incorporated into control logics.
13. 8 DO (Digital Output) terminals for monitoring and control options. 2 state output (Operation/Error) for synchronous control and monitoring. 6 general purpose outputs to control other components (on: 12VDC out; off: no voltage). Digital Outputs can be incorporated into control logics and scheduling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electric installations to verify actual locations of piping connections and electrical conduits before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting:

1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC.

B. Install wall-mounting thermostats, humidistats, and switch controls in electrical outlet boxes at heights to match lighting controls or as required.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping with unions and shutoff valves.
2. Connect condensate drain pans to indirect waste connection with condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

B. Duct installation requirements are specified in other Sections. Drawings indicate general arrangement of ducts. Specific connection requirements are as follows:

1. Connect supply and return ducts with flexible duct connectors specified in Section 233300 "Air Duct Accessories."

C. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

D. Install piping adjacent to machine to allow service and maintenance.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Adjust vibration isolators.

9. Verify bearing lubrication on fan.
10. Start unit according to manufacturer's written instructions.
11. Complete startup sheets and attach copy with Contractor's startup report.
12. Inspect and record performance of interlocks and protective devices; verify sequences.
13. Operate unit for an initial period as recommended or required by manufacturer.
14. Verify thermostat calibration.
15. Inspect controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.
16. Start refrigeration system, and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Condenser water entering and leaving temperature.

17. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 CLEANING

A. Replace filters used during construction prior to air balance or Substantial Completion.

B. After completing installation of exposed, factory-finished, air-source heat pumps, inspect exposed finishes and repair damaged finishes.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-source heat pumps.

END OF SECTION 23 8146.14

SECTION 23 8413 - HUMIDIFIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section.

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes the following type[s] of humidifiers:

1. Self-contained humidifiers for application on ducted HVAC systems.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section “Basic Mechanical Requirements.”

B. Product Data: Include rated capacities, operating weights, furnished specialties, and accessories.

C. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, and dispersion tubes.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
2. Coordination Drawings: Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, and required clearances.

D. Maintenance Data: For humidifiers to include in maintenance manuals specified in Division 23 Section “Basic Mechanical Requirements.”

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ARI 610, "Standard for Central System Humidifiers for Residential Applications."

C. Comply with ARI 620, "Standard for Self-Contained Humidifiers for Residential Applications."

D. Comply with ARI 640, "Standard for Commercial and Industrial Humidifiers."

1.5 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. Supply one replacement cylinder with each humidifier.

1.6 COORDINATION

A. Coordinate location and installation of humidifiers in ducts and air-handling units. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Self-Contained Humidifiers:

a. Dristeem
b. Armstrong International, Inc.
c. Carnes Co., Inc.
d. Herrmidifier Co., Inc.
e. Hygromatik, Spirax Sarco, Inc.
f. Neptronic Humidifiers
g. Nortec Industries, Inc.
h. Pure Humidifier Co.

2.2 SELF-CONTAINED HUMIDIFIERS

A. Description: Electric-resistance or electrode-type, electric immersion heaters within a cylinder to generate steam. Enclosure cabinet contains equipment components.

1. Remotely mounted with flexible hose connecting dispersion tube in duct airstream.
2. Space mounted with integral fan for discharging vapor directly into conditioned space.

B. Heater Cylinder: Replaceable or cleanable type.

C. Dispersion Tube: Stainless-steel tube interlocked with integral fan for discharging vapor directly into conditioned space.

D. Dispersion Tube: Stainless-steel tube extending across entire width of duct and equipped with mounting brackets for both ends of tube.

E. Cabinet: Sheet metal enclosure for housing heater cylinder, electrical wiring, components, controls, and control panel. Enclosure shall include baked-enamel finish in manufacturer's standard colors, hinged or removable access door, and threaded outlet in bottom of cabinet for drain piping.

F. Control Panel: Factory-wired disconnect switch; liquid-crystal display, programmable keyboard; set-point adjustment; warning signal indicating end of replaceable cylinder life; low-voltage control circuit; diagnostic, maintenance, alarm, and status features; and high-water sensor or float to prevent overfilling.

G. Controls: Solenoid-fill and automatic drain valves shall maintain water level and temper hot drain water; field-adjustable timer shall control drain cycle for flush duration and interval.

1. Water-Level Controller: Conductivity probe or mechanical float.

H. Optional Accessories: Include the following:

1. Humidistat: Solid-state, electronic-sensor controller capable of full modulation.
2. Duct-mounted, high-limit humidistat.
3. Network capability.
4. Airflow switch to prevent humidifier operation when there is no airflow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HUMIDIFIER INSTALLATION

A. Install with required clearance for service and maintenance.

B. Seal humidifier dispersion-tube duct penetrations with flange.

C. Install dispersion tubes pitched to drain condensate back to housing.

D. Install drip leg upstream from steam trap, a minimum of 12 inches (300 mm) for proper operation of trap.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to machine to allow service and maintenance.
2. Install shutoff valve and strainer in humidifier supply line.
3. Install backflow prevention device in humidifier supply line.
4. Connect piping with a minimum of 1-inch (25-mm) air gap in fill line to prevent backflow into supply line.

B. Electrical: Refer to Section 23 0510 “Basic Mechanical Requirements: for electrical connections to mechanical equipment.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 23 8413

SECTION 23 8858- VARIABLE FREQUENCY DRIVES

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 this Section.

B. Related Sections: The following Division 23 Sections contain requirements that relate to this Section:

1. “Basic Mechanical Requirements.”
2. “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes a.c. variable frequency drives.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 23 Section "Basic Mechanical Requirements."

B. Product data for products specified in this Section. Include dimensions, ratings, and data on featuresand components. Submit wiring diagram for each electrical control device.

C. Maintenance data for materials and products to include in the Operating and Maintenance Manual specified in Division 23 Section "Basic Mechanical Requirements."

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide solid-state, variable-speed controllers from manufacturers regularly engaged in the manufacture of equipment of the types and capacities indicated, with such products in satisfactory use in similar service for not less than 5 years. Manufacturer must also maintain, within 100 miles of the project site, a service center capable of providing training, parts, and emergency maintenance and repairs within 8 hours, 24 hours a day, seven days a week.

B. Components and Installation: NFPA 70 "National Electrical Code."

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled as a complete unit.

1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

D. NEMA Compliance: NEMA ICS 2, "Industrial Control Devices, Controllers and Assemblies."

E. UL Compliance: UL 508, "Electric Industrial Control Equipment."

F. If variable frequency drive/motor combination results in an increase of 2 dB over ambient conditions in occupied spaces, manufacturer shall provide filters or replace motors until an acceptable noise level is reached.

1.5 WARRANTY

A. Warranty on Variable frequency drive: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, defective materials and workmanship, including breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement shall include labor for removal and reinstallation.

1. Warranty Period: 2 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the following:

1. ABB Drives
2. Eaton/Cutler-Hammer
3. Danfoss

2.2 SOLID-STATE, VARIABLE-SPEED MOTOR CONTROLLERS

A. General: Provide controllers listed and labeled as a complete unit and arranged to provide variable speed of a standard NEMA Design B, 3-phase, induction motor by adjusting output voltage and frequency of controller. Controller shall be designed and rated by the manufacturer for the type of load (e.g., fans, blowers, and pumps) with which used. Controller shall also be approved by the manufacturer for the type of connection used between the motor and load. Controller shall be rate at full voltage specified (208, 230 or 480). Controller shall not cause any interference for other equipment and shall meet most stringent FCC regulations and IEEE 519 standard Special Conditions (hospitals & airports).. Controllers shall utilize line reactors to meet harmonic distortion criteria of IEEE standards.

B. Enclosures: Provide enclosures suitable for the environmental conditions at the controller location. Provide NEMA Type 1 enclosures except as otherwise indicated.

C. Ratings: As follows:

1. Output Rating: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout the voltage range.
2. Speed Regulation: Plus or minus 1 percent.
3. Ambient Temperature: 0 deg C to 40 deg C.
4. Efficiency: 97 percent minimum at full load, 60 Hz.
5. Power Factor: 95 percent or greater at any speed.
6. System (voltage & bypass) voltage tolerance of ± 15%

D. Isolated control interface to allow the controller to follow either of the following over an 11:1 speed range:

1. Electrical Signal: 4 to 20 milliamperes at 24 VDC.

E. Adjustability: Provide the following keypad adjustment capabilities:

1. Minimum Speed: 0 to 100 percent of maximum RPM.
2. Maximum Speed: 0 to 100 percent of maximum RPM.
3. Acceleration: 2 to 300 seconds.
4. Deceleration: 2 to 300 seconds.
5. Current Limit: 50 to 110 percent of maximum rating.
6. Carrier Frequency: Selectable at multiple levels between 2 KHz and 10 KHz.

F. Multiple Motor Capability: Controller suitable for service to multiple motors, and furnished with a separate overload relay and protection for each individual motor. Tripping of any overload relay shall shut off the controller and all motors served by it.

G. Self-protection and reliability features shall include:

1. Input transient protection by means of surge suppressors that comply with IEEE 587.
2. Snubber networks to protect against malfunction due to system voltage transients with capacity to withstand 120 joules.
3. Motor Overload Relay: Electronic motor protection shall be capable of predicting motor winding temperature, based on specific motor parameters, including load and speed. The overload protection shall be capable of selection to approximate either NEMA Class 10 or 20 performance. The protection shall provide an orderly shutdown should the motor thermal capability be exceeded.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Instantaneous Overcurrent Trip.
6. Loss of Phase Protection.
7. Reverse Phase Protection.
8. Under- and Over-Voltage Trips.
9. Overtemperature Trip.
10. Short Circuit Protection.
11. Provide AC line reactors for harmonic mitigation and transient suppression. Reactors shall have a minimum of 3% impedance. Provide reactors in a separate enclosure if VFD enclosure cannot accommodate reactors.
12. Adjustments requiring cutting or clipping of resistors or wires are not acceptable.
13. Output filter shall be provided when the conductor length from the motor to the motor controller exceed 50 feet. DVDT Filters shall reduce voltage spikes to comply with NEMA motor standards.

H. Automatic Reset/Restart: Attempt 5 restarts with 60 seconds between attempts after controller fault or on return of power to the system following an interruption and before shutting down for manual reset or fault correction. Provide for restarting during deceleration without damage to the controller, motor, or load. If unsuccessful in all 5 attempts, the VFD shall remain in a fault condition until manually reset.

I. Power Interruption Protection: Prevent motor re-energizing after a power interruption until motor has stopped.

J. Operation and maintenance features shall include:

1. Panel-Mounted Operator Station: A self-contained digital keypad shall be provided suitable for operation, status monitoring, and programming. Keypad shall have alpha-numeric displays to indicate power on, run, or fault conditions. All faults shall be displayed in the order they occurred and trended with the events leading up to the instant each fault occurred. Keypad shall provide start and stop push buttons along with faster and slower keys. Operator shall be able to switch from keypad control to remote control of either speed or start/stop. Changing start/stop from remote to keypad will not effect speed control and vice versa. Keypad shall be able to display and indicate; % speed, motor amps, motor volts, kilowatts, frequency, line volts, remote speed command, and status.
2. Elapsed Time Meter.
3. Integral Main Disconnect: Circuit breaker or fused disconnect connected to shut down all power to both the controller and the bypass (if provided). Interlock disconnect with cabinet door.
4. Remote Operating/Indicating Terminals: Provide a minimum of two Form-C contacts for run and fault output status. Provide one 4-20 mADC analog output for remote monitoring of actual motor speed. Provide one binary input for remote start/stop control.
5. Manual Bypass: Magnetic contactor arranged to safely transfer the motor from the controller to the power line, or from the line to the controller while the motor is at zero speed. Include Controller-Off-Bypass selector switch and indicator lights to indicate mode selection.
6. Auxiliary Motor Contactors: Electrically interlocked. One contactor connected between the controller output and the motor, controlled by the controller regulator; and one between the bypass power line and the motor, providing across-the-line starting capability in the bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.
7. Isolating Circuit Breaker: Arranged to electrically isolate the variable-speed controller to permit safe trouble-shooting and testing of the controller, both energized and de-energized, while the motor is operating in the bypass mode.
8. Single phase protection in VFD mode or bypass mode.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install variable frequency drives in accordance with manufacturer's written instructions. Installation of the drive shall allow for clearances in front of the drive as required by NEC for starter or electrical panel.

B. Location: Locate controllers as indicated and within sight of motors controlled.

C. Mounting: For control equipment at walls, bolt units to wall or mount on unistrut bolted to the wall. For controllers not at walls, provide freestanding racks fabricated of unistrut. Use feet consisting of 3/8-inch thick steel plates, 6 inches square, bolted to the floor.

3.2 CONTROL WIRING INSTALLATION

A. Control wiring not specified under Division 16 shall be work of this section. Install wiring between motor control devices and control/indicating devices as specified in Division 16 Section "Basic Electrical Materials and Methods" for hard-wired connections.

3.3 CLEANING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.

3.4 START-UP AND TRAINING

A. Provide services of a factory trained and qualified representative for system start-up, training and certification as described below.

B. At a time mutually agreed upon during system commissioning a factory trained and qualified representative of the equipment manufacturer shall give up to two hours of instruction to the Owner's designated personnel on the operation of all equipment provided under this Section and describe its intended use with respect to the functions specified. Operator orientation of the equipment shall include, but not be limited to, the equipment functions (both individually and as part of the total integrated system), operation, maintenance, procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventative maintenance, and appropriate operator intervention required in responding to the System's operation. An Owner's manual prepared for this project by the contractor shall be used in addition to the instruction (refer to Division 23 Section "Basic Mechanical Requirements."

C. Contractor shall certify to Engineer in writing that the installation is satisfactory, that all parameters have been properly adjusted, and that the Owner's representative has been trained on the operation and maintenance of the equipment. An authorized owner representative's signature should accompany this certificate to ensure the above training has been completed.

D. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements of Division 16 Sections. Do not proceed with startup until wiring installation is acceptable to equipment installer.

E. Start equipment according to manufacturer's instructions.

F. Operate and adjust controls and safeties.

G. Operate equipment, including accessories and controls, to demonstrate compliance with requirements.

H. Schedule training with Owner with at least 7 days advance notice.

END OF SECTION 23 8858

SECTION 26 0500 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements specified in Division 26 Section “Basic Electrical Requirements” apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic electrical materials and methods to complement other Division 26 Sections and for application with electrical installations:

1. Building wire and connectors.
2. Supporting devices for electrical components.
3. Electrical identification.
4. Electrical demolition.
5. Cutting and patching for electrical construction.
6. Touchup painting.
7. Miscellaneous metals for support of electrical materials and equipment.
8. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 26 Section “Basic Electrical Requirements.”

B. Product data for the following products:

1. Access panels and doors.
2. Joint sealers.

C. Shop Drawings detailing fabrication and installation of supports and anchorage for electrical items

D. Coordination Drawings for electrical installation.

1. Prepare Coordination Drawings to a 1/4-inch-equals-1-foot (1:50) scale or larger. Detail major elements, components, and systems of electrical equipment and materials in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations are important to the efficient flow of the Work. Coordinate drawing preparation with effort specified in other Specification Sections. Include the following:

a. Provisions for scheduling, sequencing, moving, and positioning large equipment in the building during construction.

b. Floor plans, elevations, and details, including the following:

1) Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
2) Equipment support details.
3) Exterior wall, roof, and foundation penetrations of cable and raceway; and their relation to other penetrations and installations.
4) Fire-rated interior wall and floor penetrations by electrical installations.
5) Sizes and locations of required concrete pads and bases.

c. Reflected ceiling plans to coordinate and integrate installing air outlets and inlets, light fixtures, alarm and communication systems components, sprinklers, and other ceiling-mounted items.

E. Samples of color, lettering style, and other graphic representation required for each identification product for Project.

F. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under “Quality Assurance.”

G. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of electrical service, and details for dust and noise control.

1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 1 Section “Summary of Work.”

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Installer Qualifications: Engage an experienced Installer for the installation and application of joint sealers, access panels, and doors.

1.5 PROJECT CONDITIONS

A. Conditions Affecting Selective Demolition: The following project conditions apply:

1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
2. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Building Wire:

a. Carol Cable Co., Inc.
b. Encore Wire & Cable Corp.
c. Rome Cable Corp.
d. Senator Wire and Cable Co.
e. Southwire Company.
f. West Penn Wire Corp.

2. Elastomeric Joint Sealers:

a. One-Part, Nonacid-Curing, Silicone Sealants:

1) "Chem-Calk N-Cure 2000," Bostic Construction Products Div.
2) "864," Pecora Corp.
3) "Rhodorsil 5C," Rhone-Poulenc, Inc.
4) "Spectrum 1," Tremco, Inc.
5) "Spectrum 2," Tremco, Inc.

b. One-Part, Mildew-Resistant, Silicone Sealant:

1) "863 #345 White," Pecora Corp.
2) "Rhodorsil 6B White," Rhone-Poulenc, Inc.
3) "Proglaze White," Tremco Corp.
4) "OmniPlus," Sonneborn Building Products Div.

3. Fire-Resistant Joint Sealers:

a. STI (Specified Technologies, Inc.)
b. 3M Fire Protection Products.
c. IPC (International Protective Coatings Corp.)
d. Hilti FS-ONE

2.2 BUILDING WIRE

A. Description: Single conductor, copper. Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

1. Optional Panelboard Feeder Conductor Material: At Contractor's option, stabiloy, aluminum-alloy conductor material may be used in lieu of copper. Conductor and raceway sizes must be changed to account for change in material.

B. Thermoplastic Insulated Wire: Conform to NEMA WC 5.

C. Cross-Linked, Polyethylene Insulated Wire: Conform to NEMA WC 7.

D. Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated. Select to comply with Project's installation requirements.

2.3 SUPPORTING DEVICES

A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.

1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated.

B. Steel channel supports have 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least 1 surface.

1. Fittings and accessories mate and match with channels and are from the same manufacturer.

C. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, fiberglass-resin channels and angles with 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least 1 surface.

1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
2. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps or "click"- type hangers.

E. Sheet-Metal Sleeves: 0.0276-inch (0.7-mm) or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.

1. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
2. Color: Black legend on orange field.
3. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide (0.08 mm thick by 25 mm wide).

D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

E. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16-inch (1.6-mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick for larger sizes. Engraved legend in black letters on white face.

F. Interior Warning and Caution Signs: Preprinted, aluminum, baked-enamel finish signs, punched for mechanical fasteners, with colors, legend, and size appropriate to the application.

G. Exterior Warning and Caution Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396-inch (1-mm), galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

H. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Fasteners: Zinc-coated, type, grade and class as required.

2.6 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer’s standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and non-porous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

D. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters’ Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

E. Fire-Resistant Joint Sealers: Hilti FS-ONE sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters’ Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.7 TOUCHUP PAINT

A. Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Nonequipment Surfaces: Matching type and color of undamaged, existing adjacent finish.

C. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.

B. Materials and Components: Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 WIRING METHODS

A. Feeders: Type THHN/THWN-2, rated for use at a continuous 90C (194F) operating temperature in wet or dry locations, insulated copper conductor, in raceway, except as otherwise indicated.

B. Branch Circuits: Type THHN/THWN-2, rated for use at a continuous 90C (194F) operating temperture in wet or dry locations, insulated conductors, in raceway.

C. Class 2 and Class 3 Control Circuits: Type THHN/THWN-2, rated for use at a continuous 90C (194F) operating temperature in wet or dry locations, in raceway.

D. Wire all branch circuits with 2-#12 & 1-#12 grd. in conduit unless indicated otherwise. All branch circuits shall include 1-#12 grd. throughout the circuit unless indicated otherwise. Wire all single phase lighting and power branch circuits with separate neutral conductor. Shared neutrals between branch circuits of different phases will not be allowed. Conductors for multiple branch circuits may be routed in the same conduit in accordance with applicable sections of the code.

3.3 ELECTRICAL SUPPORTING METHODS

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply to manufacturer's written instructions.

E. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb- (90-kg-) minimum design load.

3.4 INSTALLATION

A. Install wires in raceway according to manufacturer's written instructions and NECA's "Standard 1-2000, “Standard Practices for Good Workmanship in Electrical Contracting.”

B. Conductor Splices: Keep to the minimum and comply with the following:

1. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
2. Use splice and tap connectors that are compatible with conductor material.

C. Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.

D. Connect outlets and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

E. Install devices to securely and permanently fasten and support electrical components.

F. Raceway Supports: Comply with NFPA 70 and the following requirements:

1. Conform to manufacturer's recommendations for selecting and installing supports.
2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
6. Hanger Rods: 1/4-inch (6-mm) diameter or larger threaded steel, except as otherwise indicated.
7. Spring Steel Fasteners: Specifically designed for supporting single conduits or tubing. May be used in lieu of malleable iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to channel and slotted angle supports.
8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.

G. Vertical Conductor Supports: Install simultaneously with conductors.

H. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.

I. In open overhead spaces, cast boxes threaded to raceways need not be separately supported, except where used for fixture support; support sheet-metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

J. Firestopping: Apply to cable and raceway penetrations of fire-rated floor and wall assemblies. Perform firestopping to reestablish the original fire-resistance rating of the assembly at the penetration.

K. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Perform fastening according to the following:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

    a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.
10. Drill holes in concrete beams so holes more than 1-1/2 inches (38 mm) deep do not cut main reinforcing bars.
11. Drill holes in concrete so holes more than 3/4 inch (19 mm) deep do not cut main reinforcing bars.
12. Fill and seal holes drilled in concrete and not used.

L. Install concrete pads and bases according to requirements of this Section.

3.5 IDENTIFICATION MATERIALS AND DEVICES

A. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.

C. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.

D. Identify raceways and cables of certain systems with color banding as follows:

1. Bands: Colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of 2-color markings in contact, side by side.
2. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25 feet (8 m) in congested areas.
3. Colors: As follows:

   a. Fire-Alarm System: Red.
   b. Security System: Blue and yellow.
   c. Telecommunications System: Green and yellow.

E. Tag or label power circuits for future connection and circuits in raceways and enclosures with other circuits. Identify source and circuit numbers in each cabinet, pull box, junction box, and outlet box. Color coding may be used for voltage and phase indication.

F. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

G. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.

1. 208/120-V System as follows:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral: White.
   e. Ground: Green.

2. 480/277-V System as follows:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: White with blue stripe.
   e. Ground: Green.

3. Isolated Ungrounded 120V Systems as follows:

   a. Orange: Conductor #1
   b. Brown: Conductor #2
   c. Green: Grounding Conductor

4. Isolated Ungrounded 3 Phase Systems as follows:

   a. Orange: Conductor #1
   b. Brown: Conductor #2
   c. Yellow: Conductor #3
   d. Green: Grounding Conductor.

5. Factory-apply color the entire length of the conductors, except the following field-applied, color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

   a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply the last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
   b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

3.6 DEMOLITION

A. Where electrical work to remain is damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work Indicated to Be Demolished: Remove exposed electrical installation in its entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap and patch surface to match existing finish.

D. Removal: Remove demolished material from the Project site.

E. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.8 APPLICATION OF JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealers manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

C. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

   1. Comply with recommendations of ASTM C 962 for use of elastomeric joints sealers.

D. Tooling. Immediately after sealing application and prior to time shinning or curing begins, tool sealant to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

E. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.9 TOUCHUP PAINT

A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.

B. Follow paint manufacturer’s written instructions for surface preparation and for timing and application of successive coats.

END OF SECTION 26 0500

SECTION 26 0510 - BASIC ELECTRICAL REQUIREMENTS

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 this and the other sections of Division 26.

B. Related Sections: The following Division 26 sections contain requirements that relate to this section:

1. “Basic Electrical Materials and Methods,” for materials and methods common to the remainder of Division 26.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Electrical installations.
7. Cutting and patching.
8. Substitutions.

1.3 QUALITY ASSURANCE

A. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."

B. NFPA Compliance: Components and installation shall comply with the following:

1. NFPA 101 - Life Safety Code.

C. UL Compliance: Comply with applicable UL standards pertaining to specific types of electrical materials and components. Provide such that are UL-listed and labeled where applicable.

D. NEMA Compliance: Comply with applicable NEMA standards pertaining to specific types of electrical materials and components.

1.4 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "Submittals."

B. Increase the number of electrical related shop drawings, product data, and samples submitted, to allow for required distribution plus one copy of each submittal required, which will be retained by the Electrical Consulting Engineer.

C. Additional copies may be required by individual sections of these Specifications.

1.5 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 Section "Project Coordination," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:

    a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
    b. Exterior wall and foundation penetrations.
    c. Fire-rated wall and floor penetrations.
    d. Equipment connections and support details.
    e. Sizes and location of required concrete pads and bases.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.

1.6 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Project Closeout." In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Prepare three (3) bound Operation and Maintenance Manuals in accordance with Division 1 Section "Project Closeout." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, complete nomenclature and commercial numbers of replacement parts, and complete parts listing with part name and number.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Reviewed shop drawings and submittals.
6. Record of spare parts provided to Owner with a signature of receipt by Owner's representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products in factory-fabricated type containers or wrappings which properly protect product from damage.

C. Store products indoors in clean, dry space in original containers. Protect products from weather, construction traffic and debris. When necessary to store outdoors, take similar precautions and store above grade and enclose with waterproof covering.

D. Handle products carefully to prevent physical damage. Do not install damaged products; replace damaged products with new.

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment and material provided shall be “lead paint free” and asbestos free.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

3.2 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with reviewed submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
12. Install electrical equipment in order to maintain required clearances. Where space limitations mandate that equipment (i.e. water piping) may contribute moisture within these clearances, provide non-combustible shielding to protect electrical equipment from moisture.

3.3 ELECTRICAL CONNECTIONS TO MECHANICAL EQUIPMENT

A. Electrical: Conform to applicable requirements in Division 26 Sections.

B. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer’s published torque tightening valves. Where manufacturer’s torque valves are not indicated, use those specified in UL 486A and UL 486B.

C. Obtain all mechanical equipment control wiring diagrams from mechanical contractor so as to allow installation of field-installed control wiring in conduit between any mechanical equipment and accessories. This electrical contractor shall provide all control wiring in conduit under the supervision of the mechanical contractor, and as defined in Division 15, Section 15010. All accessories will be mounted by the contractor providing that accessory. Control wiring includes all accessories operating at 110-volts or above and 50 volts or below. Control wiring for temperature control devices shall be included in scope when a temperature control contractor is not present on the project.

D. Provide all power connections to mechanical equipment as indicated on drawings or outlined in Division 26 Sections.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "Cutting and Patching." In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:

   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
   f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.5 SUBSTITUTIONS

A. General: All changes and additional work required by this Contractor, or any other contractor, because of a substitution of an equivalent piece of equipment by this Contractor, shall be the responsibility of this Contractor. Substitutions will only be considered when the quality of the product is maintained and it is advantageous to the Owner to consider.

B. Requests for approval to bid equipment by a manufacturer not listed in these specifications must be received by A/E, in written form, a minimum of ten (10) calendar days prior to bid date.

3.6 CLEANING

A. All equipment and installed materials shall be cleaned inside and outside. All construction dust and loose materials shall be removed. Any printed information attached to the equipment shall be removed and included in the Operation and Maintenance Manuals. Equipment nameplates shall NOT be removed. Any scratched paint surfaces shall be repaired with manufacturer's touch-up paint.

END OF SECTION 26 0510

SECTION 26 0519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section.

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section “Basic Electrical Requirements.”

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

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.

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 Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Wires and Cables:

a. Alcan Aluminum Corporation; Alcan Cable Div.
b. American Insulated Wire Corp.; Leviton Manufacturing Co.
c. BICC Brand-Rex Company.
d. Carol Cable Co., Inc.
e. Senator Wire & Cable Company.
f. Southwire Company.
g. Rome

2. Connectors for Wires and Cables:

a. AMP Incorporated.
b. General Signal; O-Z/Gedney Unit.
c. Monogram Co.; AFC.
d. Square D Co.; Anderson.
e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. 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.

B. Rubber Insulation Material: Comply with NEMA WC 3.

C. Thermoplastic Insulation Material: Comply with NEMA WC 5.

D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.

E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.

F. Conductor Material: Copper.

G. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

2.3 CONNECTORS AND SPLICES

A. 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. Feeders: Type THHN/THWN, in raceway.

B. Branch Circuits: Type THHN/THWN, 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. Remove existing wires from raceway before pulling in new wires and cables.

C. 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.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."

G. Seal around cables penetrating fire-rated elements.

H. Identify wires and cables according to Division 26 Section "Basic Electrical Materials and Methods."

3.4 CONNECTIONS

A. Conductor Splices: Keep to 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. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

F. 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. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

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.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section.

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”

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 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.
b. Chance/Hubbell.
c. Copperweld Corp.
d. Harger Lightning Protection, Inc.
e. Heary Brothers Lightning Protection Co.
f. O-Z/Gedney Co.; a business of the EGS Electrical Group.
g. Raco, Inc.; Division of Hubbell.

h. Robbins Lightning, Inc.
i. Salisbury: W. H. Salisbury & Co.
j. Superior Grounding Systems, Inc.
k. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."

B. Material: Copper-clad aluminum, and copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded cable.

F. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 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.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

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.
7. Armored and metal-clad cable 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.

3.3 INSTALLATION

A. 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.

B. 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.

C. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.4 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.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. 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.

C. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

E. 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.

END OF SECTION 26 0526

SECTION 26 0533 - 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.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:

1. "Basic Electrical Requirements."
2. "Basic Electrical Materials and Methods" for raceways and box supports.
3. "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:

a. Rigid metal conduit (RMC).
b. Intermediate metal conduit (IMC).
c. Electrical metallic tubing (EMT).
d. Flexible metal conduit (FMC).
e. Liquidtight flexible nonmetallic conduit (LFNC).
f. Rigid nonmetallic conduit (RNC).
g. Wireways.
h. Surface raceways.

2. Boxes, enclosures, and cabinets include the following:

a. Device boxes.
b. Floor boxes.
c. Outlet boxes.
d. Pull and junction boxes.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section "Basic Electrical Requirements."

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

C. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in 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 NECA's Standard 1-2000, “Standard Practices for Good Workmanship in Electrical Contracting."

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:

a. AFC Cable Systems, Inc.
b. Alflex Corp.
c. Anamet, Inc.; Anaconda Metal Hose.
d. Grinnell Co.; Allied Tube and Conduit Div.
e. Republic Conduit Div., Maverick Tube Corp.

2. Nonmetallic Conduit and Tubing:

a. Anamet, Inc.; Anaconda Metal Hose.
b. Hubbell, Inc.; Raco, Inc.
c. Lamson & Sessions; Carlon Electrical Products.
d. Thomas & Betts Corp.

3. Conduit Bodies and Fittings:

a. American Electric; Construction Materials Group.
b. Crouse-Hinds; Div. of Cooper Industries.
c. Emerson Electric Co.; Appleton Electric Co.
d. Hubbell, Inc.; Killark Electric Manufacturing Co.

e. Lamson & Sessions; Carlon Electrical Products.
f. O-Z/Gedney; EGS.
g. Scott Fetzer Co.; Adalet-PLM.
h. Spring City Electrical Manufacturing Co.

4. Insulating Bushings:

a. Arlington Industries.
b. Bridgeport Fittings.
c. Regal Fittings; Crefton Industries.

5. Metal Wireways:

a. Hoffman Engineering Co.
b. Square D Co.

6. Surface Metal Raceways:

a. American Electric; Construction Materials Group.
b. Wiremold Co. (The); Electrical Sales Division.

7. Boxes, Enclosures, and Cabinets:

a. American Electric; FL Industries.
b. Crouse-Hinds; Div. of Cooper Industries.
c. Hubbell Inc.; Killark Electric Manufacturing Co.
d. Hubbell Inc.; Raco, Inc.
e. Lamson & Sessions; Carlon Electrical Products.
f. O-Z/Gedney; EGS.
g. Scott Fetzer Co.; Adalet-PLM.
h. Spring City Electrical Manufacturing Co.
i. Thomas & Betts Corp.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. Rigid Aluminum Conduit: ANSI C80.5.

C. IMC: ANSI C80.6.

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Set-screw or compression type. (Steel Only)

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.

2.4 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA70.

D. Wireway Covers: As indicated

E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.6 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.7 FLOOR BOXES

A. Floor Box Type 1: Cast metal, fully adjustable, rectangular. Walker 880 Series with number of gangs indicated and brass 828R duplex lift lids and trim plates as required for floor material.

B. Floor Box Type 2: Sheet steel, fully adjustable, rectangular. Walker RFB Series with RAKM11 cover and trim plates as required for floor material.

2.8 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

2.9 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Exposed: EMT or RNC.
2. Concealed: EMT, ENT, or RNC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Raceway and Conduit Identification: provide a permanent label on each conduit indicating the source (panel board, distribution board or switchboard) and circuit number at each junction box, pull box or enclosure. Legible and neat handwritten text using a permanent marker will be acceptable method. The identification shall be visible from the accessible side of the box or enclosure.

B. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

C. Minimum Raceway Size: 3/4-inch trade size (DN21).

D. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Install raceways level and square and at proper elevations. Provide adequate headroom.

G. Complete raceway installation before starting conductor installation.

H. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."

I. Use temporary closures to prevent foreign matter from entering raceways.

J. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

K. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

L. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

M. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

P. Tighten set screws of threadless fittings with suitable tools.

Q. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Use 2 locknuts: 1 inside and 1 outside the box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

S. Install plastic insulating bushing on concealed and exposed EMT conduit end for low-voltage wiring, including telephone, data, communication, video, fire alarm and temperature controls rough-in applications.

T. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

U. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

V. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections. At the contractor’s option, MC cable may be substituted for flexible conduit for connection to light fixtures, 6 feet maximum length.

W. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

X. Set floor boxes level and trim after installation to fit flush to finished floor surface.

Y. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 0533

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section.

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”

1.2 SUMMARY

A. This Section includes occupancy sensors, and multipole lighting relays and contactors.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section “Basic Electrical Requirements.”

B. Product Data: Include dimensions and data on features, components, and ratings for lighting control devices.

C. Samples: Occupancy sensors for color selection and evaluation of technical features.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 26 Section “Basic Electrical Requirements.”

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified in this Section and in Division 26 Sections.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.

C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Contactors and Relays:

a. Cutler-Hammer Products; Eaton Corporation.
b. GE Lighting Controls.
c. Hubbell Lighting, Inc.
d. Square D Co.; Power Management Organization.

2. Occupancy Sensors:

a. Watt Stopper, Inc. (The).
b. Hubbell Lighting, Inc.
c. Leviton Manufacturing Co., Inc.
d. Lithonia Control Systems.

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

2.3 OCCUPANCY SENSORS

A. Ceiling-Mounting Units: Unit receives 24-V dc power from a remote source and, on sensing occupancy, closes contacts that provide signal input to a remote microprocessor-based lighting control system.

B. Switch-Box-Mounting Units: Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts rated 800 W at 120-V ac, and 1000 W at 277-V ac, minimum.

C. Operation: Turns lights on when room or covered area is occupied and off when unoccupied, unless otherwise indicated.

1. Time Delay for Turning Lights Off: Adjustable over a range from 1 to 15 minutes, minimum.
2. Manual Override Switch: Turns lights off manually regardless of elapsed time delay.
3. Isolated Relay Contact: Operates on detection of occupancy or vacancy, as indicated, to activate an independent function.

D. Auxiliary Power and Control Units: As follows:

1. Relays rated for a minimum of 20-A normal ballast load or 13-A tungsten filament or high-inrush ballast load.
2. Sensor Power Supply: Rated to supply the number of connected sensors.

E. Passive-Infrared Type: Detects occupancy by a combination of heat and movement in zone of coverage. Each sensor detects occupancy anywhere in an area of 1000 sq. ft. (93 sq. m) by detecting occurrence of 6-inch (150-mm) minimum movement of any portion of a human body that presents a minimum target of 36 sq. in. (232 sq. cm) to the sensor.

F. Ultrasonic Type: Emits a beam of ultrasonic energy and detects occupancy through use of Doppler's principle in discerning movement in zone of coverage by sensing a change in pattern of reflected ultrasonic energy. Basis of design: Watt Stopper W-500A or W-1000A to suit area to be covered.

G. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in the field by operating controls on unit. Basis of design: Watt Stopper DT-100L.

H. Automatic Wall Switch: Occupancy is detected by a combination of heat and movement in zone of coverage. Each sensing head detects occupancy anywhere in an area of 900 sq. ft. (93 sq. m) by detecting occurrence of 6-inch (150-mm) minimum movement of any portion of a human body that presents a minimum of 36 sq. in. (232 sq. cm) to sensor head. Basis of design: Watt Stopper WS-120.

2.4 MULTIPOLE CONTACTORS AND RELAYS

A. Description: Electrically operated and mechanically held, and complying with UL 508 and NEMA ICS 2.

1. Current Rating for Switching: UL listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballasts with 15 percent or less total harmonic distortion of normal load current).
2. Control Coil Voltage: Match control power source.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment level and plumb and according to manufacturer's written instructions.

B. Mount lighting control devices according to manufacturer's written instructions and requirements in Division 26 Section "Basic Electrical Materials and Methods."

C. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

3.2 CONTROL WIRING INSTALLATION

A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Division 26 Sections “Basic Electrical Materials and Methods” and "Conductors and Cables" for low-voltage connections.

B. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes."

C. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes," unless run in accessible ceiling space and gypsum board partitions.

D. Bundle, train, and support wiring in enclosures.

E. Ground equipment.

F. Connections: 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.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Basic Electrical Materials and Methods."

3.4 FIELD QUALITY CONTROL

A. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.

B. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

C. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.

D. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:

1. Continuity tests of circuits.
2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

    a. Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

E. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

F. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

G. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.5 CLEANING

A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

3.6 DEMONSTRATION

A. Coordinate with training for low-voltage, programmable lighting control system specified in Division 26 Section “Basic Electrical Materials and Methods."

3.7 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

END OF SECTION 26 0923

SECTION 26 2416 - 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.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”

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:

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section “Basic Electrical Requirements.”

B. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. 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.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 26 Section “Basic Electrical Requirements.” Also 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.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 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. Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Square D Co.

b. Eaton Corp.; Cutler-Hammer Products.
c. General Electric Co.; Electrical Distribution & Control Div.

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

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.

G. Main and Neutral Lugs: 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: Adequate for branch-circuit equipment ground conductors; insulated from box.

K. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

L. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

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.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. AIC Rating: Provide minimum short circuit rating of panel and devices of 22,000 RMS symmetrical amps unless otherwise noted.

C. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

D. Basis of design is Square D NQ 120/208V and NF 277/480V panels.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Work."

C. Mounting Heights: Top of trim 74 inches (1880 mm) 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. 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.

F. Install filler plates in unused spaces.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

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; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

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. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing: 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 7.5 for switches and 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, but not more than 60 days after Final Acceptance, 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. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
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.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

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 26 2416

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”
3. “Raceways and Boxes.”

1.2 SUMMARY

A. This Section includes various types of receptacles, connectors, switches, floor outlets, power poles, and finish plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section “Basic Electrical Requirements.”

B. Product Data: For each product specified.

C. Shop Drawings: Legends for receptacles and switch plates.

D. Samples: For devices and device plates for color selection and evaluation of technical features.

E. Maintenance Data: For materials and products to include in Maintenance Manuals specified in Division 26 Section “Basic Electrical Requirements.”

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70, “National Electrical Code.”

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Hubbell, Inc.; Kellems Div.
b. Leviton Manufacturing Co., Inc.
c. Lutron Electronics Co., Inc. (dimmer switches).
d. Pass & Seymour/Legrand; Wiring Devices Div.
e. Prescolite Controls (dimmer switches).
f. Eaton Wiring Devices

2. Poke-throughs and Floor Service Boxes:

a. Hubbell, Inc.; Wiring Devices Div.
b. Square D Co.
c. Thomas & Betts Corp., Steel City Division.
d. Walker.

2.2 RECEPTACLES

A. Comply with NEMA Standards WD 1 and WD 6, "General Purpose Wiring Devices."

B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.

C. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with Federal Specification WC-596F and heavy-duty commercial specification grade of UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide NRTL labeling of devices to verify these compliances. Provide 20A duplex receptacles, 3 wire grounding type NEMA 5-20R unless indicated otherwise on the plans.

D. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:

1. Ground-Fault Circuit Interrupter Receptacles (GFCI): UL Standard 943, Class A, feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

2. Isolated-Ground Receptacles: Equipment grounding contacts are connected only to the green grounding screw terminal of the device and have inherent electrical isolation from the mounting strap. Provide 20A duplex receptacles, NEMA 5-20R unless indicated otherwise on plans.

   a. Devices: Listed and labeled as isolated-ground receptacles.
   b. Isolation Method: Integral to the receptacle construction and not dependent on removable parts.
   c. Color: Isolated ground receptacles shall be orange or have an orange triangle on the device face.

3. Weatherproof Receptacles: Provide Ground-Fault Circuit Interrupter (GFCI) receptacles as specified above with hinged weather resistant and gasketed cover similar to Hubbell RW57300 or equal.

2.3 SWITCHES

A. Snap Switches: Quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification WS-896E. Devices shall have grounding terminal.

2.4 WALL PLATES

A. Single and combination types match corresponding wiring devices. Wall plates provided shall be by the same manufacturer as devices furnished.

1. Material for Finished and Unfinished Spaces:

   a. Receptacles: Type 302, satin-finished stainless steel. Professional engrave the face of the cover plate with 3/16” high text that provides the source and the circuit number (example = “ECH3B - #1”
   b. Switches: Type 302, satin-finished stainless steel.

2.5 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box unit with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

1. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness. Observe UL spacing requirements; minimum space of 2’ O.C. and not more than one unit per each 65 sq.ft. of floor area in each space.
2. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
3. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
4. Wiring: Three No. 12 AWG power and ground conductors; one 75-ohm coaxial telephone/data cable; and one four-pair, 75-ohm telephone/data cable.

2.6 FINISHES

A. Color: Gray, unless otherwise indicated or required by Code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

D. Protect devices and assemblies during painting.

E. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Basic Electrical Materials and Methods."

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. Ground-Fault Circuit Interrupter (GFCI) Protected Receptacles: Use identification labels provided with GFCI receptacle and label face plate of downstream receptacles protected by feed-through type GFCI receptacles.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. solated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

D. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

3.6 WIRING DEVICE SCHEDULE

Device Description	Manufacturer Model Numbers			
	Hubbell	Leviton	Legrand Pass&Seymour	Eaton
Receptacle (Commercial application)	5362	5362	5362	5362
Receptacle (GFCI)	GFRST20GY	GFNT2	2097	SGF20
Receptacle - Outdoor (GFCI)	GFWRST20GY w/ RW57300	GFWR2	2097TRWR	WRSGF20
Receptacle (isolated ground)	IG5362	5362-IG	IG5362	IG5362
Snap Switch (SPST)	1221	1221-2	PS20AC1	1221
Snap Switch (3-way)	1223	1223-2	PS20AC3	1223
Snap Switch (4-way)	1224	1224-2	PS20AC4	1224

REFER TO FINISHES SECTION FOR DEVICE COLOR

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this section.

1. "Basic Electrical Requirements."
2. "Basic Electrical Materials and Methods."

1.2 SUMMARY

A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controllers, and motor-control centers; and spare fuse cabinets.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section "Basic Electrical Requirements."

B. Product Data: Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings for each fuse type indicated.

C. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

D. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.

1. For each adjusted fuse, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

E. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 26 "Basic Electrical Requirements."

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (4.4 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.

1. Fuses: Quantity equal to ten percent of each fuse type and size, but not fewer than three of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.; Bussmann Div.
2. Gould Shawmut.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Provide fuse types and classes as indicated on electrical schedules.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare fuse cabinet[s].

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section.

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”
3. "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
4. "Fuses" for fusible devices.

1.2 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Feeder and branch-circuit protection.
2. Motor and equipment disconnecting means.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 26 Section "Basic Electrical Requirements.”

B. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings: For each switch and circuit breaker.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. 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. Current and voltage ratings.
c. Short-circuit current rating.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

D. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 26 Section “Basic Electrical Requirements.” In addition, include the following:

1. Routine maintenance requirements for components.
2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA AB 1 and NEMA KS 1.

D. Comply with NFPA 70.

E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Fusible Switches:

a. Eaton Corp.; Cutler-Hammer Products.
b. Siemens Energy & Automation, Inc.
c. Square D Co.

2. Molded-Case Circuit Breakers:

a. Eaton Corp.; Cutler-Hammer Products.
b. Siemens Energy & Automation, Inc.
c. Square D Co.

3. Combination Circuit Breaker and Ground-Fault Trip:

a. Eaton Corp.; Cutler-Hammer Products.
b. Siemens Energy & Automation, Inc.
c. Square D Co.

4. Molded-Case, Current-Limiting Circuit Breakers:

a. Eaton Corp.; Cutler-Hammer Products.
b. Siemens Energy & Automation, Inc.
c. Square D Co.

2.2 ENCLOSED SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
7. Molded-Case Switch: Molded-case circuit breaker without trip units.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Compression style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system.
5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
7. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosures before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with mounting and anchoring requirements specified in Division 26 Section " Basic Electrical Materials and Methods."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

C. 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. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing: After installing enclosed switches and circuit breakers 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 7.5 for switches and 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. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches and circuit breakers checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. 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 26 2816

SECTION 26 5100- LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:

1. “Basic Electrical Requirements.”
2. “Basic Electrical Materials and Methods.”

1.2 SUMMARY

A. This Section includes lighting fixtures, lamps, ballasts, emergency lighting units, pole standards and accessories.

1.3 DEFINITIONS

A. Emergency Lighting Unit: A fixture with integral emergency battery-powered supply and the means for controlling and charging the battery. It is also known as an emergency light set.

B. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.

C. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.

D. Lighting Unit: A fixture or an assembly of fixtures with a common supports, including a pole or bracket plus mounting and support accessories.

E. Luminaire: A fixture.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 26 Section "Basic Electrical Requirements."

B. Product Data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:

1. Outline drawings indicating dimensions and principal features of fixtures.
2. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.
3. Battery and charger data for emergency lighting units.

C. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

D. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

E. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

G. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 26 Section “Basic Electrical Requirements.”

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 ANSI C2.

C. Comply with NFPA 70.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

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 MANUFACTURERS

A. Subject to compliance with requirements, provide one of the products specified in each Interior Lighting Fixture Schedule.

1. Lighting Fixtures:

a. Columbia Div., USI Lighting (C)
b. Lithonia Lighting Div; Nat.'l Service Ind. Inc. (L)
c. Metalux Div.; Cooper Industries Co. (M)
d. Sure-Lites Div.; Cooper Industries (SL)
e. H.E. Williams, Inc. (W)

2. Emergency Lighting Units:

   a. Bodine Co.
   b. Iota Engineering Co.

2.2 INTERIOR FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum; except where greater thickness is indicated.

F. Fixture Support Components: Comply with Division 26 Section "Basic Electrical Materials and Methods."

1. Ceiling Compatibility: Include accessories as required to allow fixture installation in indicated ceiling types, modules, suspension systems. Fixtures to be installed in fire-rated ceilings shall include ballasts and be of construction suitable for such installation.

2.3 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Incandescent, two for each fixture, 50,000 hours rated lamp life.
2. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours rated lamp life.
3. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.
4. Additional Lamps for DC Operation: Two minimum, bayonet-base type, for connection to external dc source.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
5. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

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: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

C. Provide individual, local disconnecting means for all ballasted, fluorescent light fixtures similar to a Thomas and Betts model LD2 or LD3 disconnect. Install the disconnecting means in accordance with the NEC.

3.2 CONNECTIONS

A. Make electrical connections to lighting fixtures prior to energizing circuits in order to avoid premature ballast failure or damage. Ballasts connected to an energized circuit may require replacement according to the judgement of the Engineer.

B. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where 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. Replaced damaged fixtures and components.

B. Give advance notice of 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. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
3. Verify normal transfer to battery source and retransfer to normal.
4. Report results in writing.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

F. Report results of tests.

G. Replace fixtures that show evidence of corrosion during Project warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 5100